IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF WEST VIRGINIA

AT HUNTINGTON

OHIO VALLEY ENVIRONMENTAL COALITION, INC., and WEST VIRGINIA HIGHLANDS CONSERVANCY, INC.,

Plaintiffs,

v. CIVIL ACTION NOS. 3:07-00413, 3:08-00088, 3:09-01167

APOGEE COAL COMPANY, LLC, and HOBET MINING, LLC,

Defendants.

Huntington, West Virginia
August 11, 2010

TRANSCRIPT OF BENCH TRIAL - DAY 3
BEFORE THE HONORABLE ROBERT C. CHAMBERS
UNITED STATES DISTRICT JUDGE

APPEARANCES:

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I N D E X

Wednesday, August 11, 2010, at 9:05 a.m. in open court

THE COURT: All right. Are we ready to proceed?

MR. LOVETT: We are, Your Honor.

THE COURT: All right. Mr. Schroeder, if you'd come up and take the stand again.

THE WITNESS: Bring this? (Indicating)

THE COURT: Yes, you may.

BY MR. LOVETT:

Q. Good morning, Mr. Schroeder.

A. Good morning.

Q. I'd like to turn your attention back to the 10-Q, the most recent 10-Q, which is Joint Exhibit 36. I think when you -- when we concluded yesterday evening, I was trying to understand your financial position.

A. Uh-huh.

Q. I think I almost finished with that part of the examination, but I'd like just to complete it and make sure I understand what the situation is.

So as I recall your testimony from yesterday, you have a credit line, a credit facility of four hundred and -- was it twenty-seven million dollars?

A. 427.5 million.

Q. I went back and looked at your deposition. I think, though, that not all of that is available now; is that right?

A. That is correct.

Q. It's $93 million that's available, or what is the number that's available?
A. Yes, roughly 93 million. There are letters of credit of approximately 335 million that were outstanding as of June 30th.
Q. Okay.
A. So that amount would be a reduction of the 427.5 million.
Q. So you have 93 million available there to do what you want with, right?
A. Yes, there's 93 million available.
Q. And you have $125 million securitized receivables?
A. That is correct. There is a facility called accounts receivable securitization that totals 125 million.
Q. And at least a hundred of that is available for any one project, right?
A. There's a sub-limit of 100 million for a line of -- for letters of credit.
Q. Then you have $239 million in cash.
A. Yes, June 30th, 239.2 million.
Q. Has that changed since then?
A. Yes.
Q. What is the current situation?
A. I don't know the balance. I mean we close our books on a monthly basis, so the balance would have changed. I don't know what it is right now.

Q. Have there been any substantial changes to that balance?
A. I would say the balance is probably somewhere between 200 million and 239 million.
Q. Okay. Do you expect to spend more than 50 million of that in the next six to nine months?
A. I'll answer it this way. I think the balance would be expected to be at least 150 million by the end of the year.
Q. Okay. And for the securitized receivables, what would you expect that that could go to by the end of the year?
A. I'm not really sure. I mean it really depends on what happens with operations between now and the end of the year, what happens with coal prices between now and the end of the year. As of this point, we -- or as of June 30th, I guess I should say, there was no amount borrowed against the accounts receivable securitization.
Q. Okay. And with the credit line, do you expect a material change in that over the next several months?
A. No, I don't. I expect that to be 427.5 million.
Q. What about the available money under that credit line?
A. I wouldn't expect to have any borrowings. The letter of credit side, I do expect some additional letters of credit between now and the end of the year.
Q. In any event, when I total those three, I come up with approximately $457 million. Does that sound reasonable to you as an amount of money that Patriot has to spend over the next

several months or years?
A. We refer to it -- I refer to it as liquidity. So liquidity, if you include cash, plus the amount available in the accounts receivable securitization, plus the amount available in the credit line, would be a number in excess of 400 million.
Q. Okay. One other line on the -- we were at the page -- I guess it's page 2. It's the condensed consolidated balance sheet. Do you have that in front of you?
A. Yes, I do.
Q. And have the total stockholder equity at the bottom there; is that right?
A. Yes.
Q. Is that essentially the net worth of the company?
A. That is the net worth of the company.
Q. And was that $942,107,000 as of your last reporting period?
A. Yes.
Q. And has that changed materially since then?
A. Materially, no.
Q. Okay. So if Patriot were ordered by the Court to post a $100 million or $95 million letter of credit or to establish an escrow account with $100 million in it to treat selenium, it has the financial resources to do that; is that true?
A. Yes. Can I add a little bit more to that?

Q. Sure.
A. We also have covenants within our revolving credit agreement and our AR securitization. So if there were some additional monies either in a -- or additional funds either through a letter of credit or through money set aside, that could or would impact the covenant calculations. So on some of those covenant calculations, there could be some factors that would bump up against some existing covenants that are in the credit facilities.
Q. Okay. That's pretty general. I'm not sure I understand it. Could you be a little bit more specific about what could happen if the Court ordered Patriot either to post a letter of credit or to place $95 million in an escrow account?
A. Yeah, $95 million would increase one of our -- let me talk about one of our covenants. It's called a leverage covenant.
Q. And what is this a covenant to?
A. It's a covenant in the revolving credit agreement.
Q. Okay.
A. The leverage covenant tracks something defined as funded net debt divided by, as defined, EBITDA.
Q. Right. What does EBITDA stand for?
A. Earnings before interest, taxes, depreciation, amortization.
Q. Okay.

A. That calculation includes funded debt, which is the typical borrowings that you have, plus it includes certain letters of credit. And maybe if I -- I'll say the exclusion of letters of credit are those related to certain areas like Workers' Compensation, retiree health care, certain bonding of reclamation.

If the Court were to, say, post an additional 95 million I think was your example, I think that 95 million would add to the definition of net funded debt, and that calculation then would get closer to the covenant limit, which is 3.0. If we were to go above 3.0, that is defined as an event of default within the credit agreement and there's some consequences that could happen there, not the least of which is discussions with the bank as to -- banks as to next steps.

Q. Well, that's -- you're talking only about the credit facility now, right?

A. Yes, I am.

Q. And as I understand your testimony, you don't know right now if you were asked to post that letter of credit whether it would ripple through and have other financial consequences to the company, right?

A. I think it would, but I don't know for sure.

Q. But you also have $125 million in securitized receivables, right?

A. Yes, I do.

Q. You could post a letter of credit from that, couldn't you?
A. But it would still count towards the net funded debt in the definition under the credit facility.
Q. Okay. And the $239 million in cash --
A. Yes.
Q. -- you could take $95 million from that and place it in an escrow account, couldn't you?
A. Yes.
Q. Okay.
A. That would also count -- the definition of net funded debt includes cash.
Q. And explain to me one more time what the -- how the change in the net funded debt would affect Patriot's operations materially.
A. Well, the change in the net funded debt would impact the numerator of the calculation; and to the extent there is an additional amount included in net funded debt, the calculation, the numerator and therefore the end result would be a higher number. To the extent it's a higher number, it gets closer to the covenant restriction of three.
Q. You don't come here prepared to tell us any effect, specifically, that an imposition of a requirement of an escrow account or letter of debt would impact your operations.
A. Well, I guess what I've said is that I do think it would

count against the covenant.
Q. I understand.
A. And therefore it would impact the end result of that covenant.
Q. How would it impact the end result of the covenant?
A. The covenant at the end of June was 1.8 to 1.
Q. Okay.
A. And increasing the numerator by 95 million would change that to roughly 2.4, 2.5 to 1 --
Q. Okay.
A. -- as of June 30th.
Q. And what would that mean in the real world, the change of the covenant from 1.8 to 2.4?
A. In the real world, I guess, or in the banking world, or in our operations, it would say the closer we are to 3.0, the more difficult it is to operate.
Q. To borrow more money?
A. To borrow more money, to spend money, yes.
Q. Okay. But as I understand your testimony, $100 million or $95 million would take you to 2.4 to 1, still significantly below 3 to 1.
A. Yes. And I guess I would add to that the denominator is EBITDA.
Q. Right.
A. And EBITDA is a rolling 12-month calculation. So as of

June 30th, the numbers that I gave you would be 2.4, roughly, 2.5. As you go forward into September 30th, then you have another quarter of EBITDA that is added on and a quarter that drops off.

So going forward, it has an impact in that 2.4 is less than 3, but as you go forward, variables, not the least of which is the coal, what's going on with coal prices, coal operations, etcetera, could impact the denominator.

Q. The number could actually go down, couldn't it, depending on what happens?

A. It could go either way naturally.

Q. Now, you heard testimony yesterday from -- I think it was yesterday -- yesterday or the day before -- from Mr. McHale that he had spoken with you about the potential treatment with the FBR at the Apogee site I think sometime either earlier this week or -- no, strike that. In the middle of last week.

A. I've spoken with Mr. McHale a couple of times last week and earlier this week, on Monday.

Q. And in the middle of last week, I think he told you that CH2M Hill was proposing that it would cost approximately $40 million without equalization of flows to treat the water at the three Apogee outfalls; is that right?

A. He did have an estimate of around $40 million for treating the three outfalls.

Q. And at the time did you think that it was likely or

reasonably likely that that would be the result of the amount of money you would have to pay to resolve the liability at the Apogee outfall?

A. No.

Q. Why not?

A. I thought it was a possibility, but I did not think it was reasonably likely I think was the words you used.

Q. They were. Well, what did you think at the time was a reasonably likely outcome?

A. The liability that we have right now is based on doing the ZVI method, that remediation over the time period that is laid out, and at this point I think that is still the reasonably likely methodology and time period.

Q. Has any engineering firm or your own company produced a report showing that ZVI is an appropriate treatment technology?

A. I'll point back to the Potesta report that indicated ZVI -- I think the words in there were something -- they may not have used most likely.

Q. I think that it said it was best available technology. Is that what you mean?

A. Those are the words I was looking for. They are specific words, but yes.

Q. So you're relying on the Potesta statement that it is best available technology back in January of 2009?

A. Their report was in July of 2009. I think those are the words that were in the July 2009 report, and that's what I'm relying on at this point.

Q. Okay. Let's turn to the July 2009 report one more time, and I think we're almost finished with your testimony.

THE COURT: Which exhibit number is that?

MR. LOVETT: It's Plaintiff's Exhibit 60, Your Honor.

BY MR. LOVETT:

Q. Now, after the cross-examination yesterday on this document and after your -- I guess it was cross-examination -- your examination yesterday on this document and after your deposition, were you curious enough to go back and look at the document and try to understand how the flow numbers are arrived at?

A. I did not take this document with me last night.

Q. Did you think about it?

A. I thought about a lot of how the day went yesterday, but --

Q. Okay.

A. -- I guess this was part of it.

Q. Let me turn your attention to -- I just want to try to make sure I understand this document. Table 2 at the back, we looked at this yesterday. It estimates installation costs, capital costs for adverse and favorable conditions, right?

A. Yes.
Q. And the adverse condition is $406,705; is that right?
A. Yes.
Q. Then let's look to page 2 of the document. Do you see where it says Treatment System and Operating Cost? Do you see that section?
A. Yes, I do.
Q. It says, "Tables 2 and 3 summarize the actual operating costs required to implement several ZVI treatment systems currently installed at Hobet, Catenary, and Apogee. Potesta believes that these costs represent a reasonable cost basis for the installation of future systems." Right?
A. Yes.
Q. It believes then -- and it tells you to look at the table, in effect -- Tables 2 and 3 summarize it -- to understand how the costs were calculated, right?
A. It refers to Table -- this section refers to Tables 2 and 3, yes.
Q. Table 2 we just looked at, and it says that you have four hundred and six seven oh five for an adverse --
A. As the adverse.
Q. Now, let's turn to -- let's look at the spreadsheets. I want -- there's more than one. Let's just turn to the third spreadsheet. I think that's Apogee. It says --
THE COURT: Is that page 060?

MR. LOVETT: 00059.

BY MR. LOVETT:

Q. And it has outfalls. These are the outfall numbers for the Apogee permit. Outfalls 1, 2, and 3. Do you see those?

A. Yes, I do.

Q. Let's just look at Outfall 2. And the reason I'm looking at Outfall 2, I'll tell you, is because I think that Numbers 1 and 3 are mixed up. 1 should be 3, and 3 should be 1. I think Potesta made a mistake. But to avoid that, let's just use Number 2 as an example. It lists Outfall 2 as adverse, right?

A. Yes, it does.

Q. And if you follow the line across, the first boxes are for months, for operating costs, right, and capital costs, and it has zero through there?

A. Yes.

Q. That is not going to be installed, they're saying, for the first quarter of 2010, right?

A. Correct. Those were -- the numbers show up in the first quarter of 2010 section.

Q. And the system installation cost there is $406,705, right?

A. Yes.

Q. And, of course, that's the same number from Table 2 for the adverse number.

A. Yes.
Q. So that indicates that the total system cost to Outfall 2 is going to be $406,000, right?
A. Yes.
Q. So that leads to the conclusion that based on what we know from Table 3 that it's going to treat 24 gallons per minute of flow, that that figure represents the treatment of 24 gallons.
A. Again, I'm not sure I see the 24 gallons, but if you could point it out to me --
Q. It says flow rate for treatment train, right, 12? It has tanks per treatment train, three. So you know there are three treatment trains, right?
A. Yes.
Q. We know that the gallons per minute is four. So you know therefore that the flow rate, if you have three tanks, to get to the 12, which is what the treatment train treats, that it needs three tanks, because three times four is twelve, right?
A. Three times four is twelve.
Q. Therefore, each of these -- this number represents six -- or two trains of six tanks each will treat 24 gallons, two tanks -- strike that.
Two tanks -- three -- two trains of three tanks each will treat 24 gallons per minute.
A. I see the three tanks and the four. I'm sorry. I don't

really understand how the actual calculation works. I can do three times four. I think you probably pointed that out.

Q. Well, you know that there's three tanks per train and that they treat four gallons each and that the flow rate per treatment train is twelve, right?

A. I see all those numbers, yes.

Q. Do you understand them?

A. Honestly, no, I don't understand the flow rate. I can do the math, but I don't understand the flow rate and how that works in the trains and the tanks per train.

Q. Okay. And you've -- I'm almost finished. You've made no attempt to understand that at the time that it was submitted to you, right?

A. Well, "no attempt" is probably an exaggeration.

Q. Did you sit down and puzzle over it for a minute?

A. I probably looked at this page. I don't think there was a reason for me to specifically understand the number of tanks in each train and the flow rate that would support each tank. I'm not an engineer. I rely on my engineer for that help.

Q. Evidently Ernst & Young was concerned about it, though, right?

A. As yesterday's comment, Ernst & Young had a question around this area, and it looks like John McHale responded to them.

MR. LOVETT: Okay. That's all I have. Thank you.

THE COURT: All right. Mr. Gardner?

CROSS EXAMINATION

BY MR. GARDNER:

Q. Good morning.

A. Good morning.

Q. I will try to be brief in my questions. Let's go back just a moment, please, to the document that Mr. Lovett just asked you to discuss. This is Plaintiff's Exhibit 60, the July 29, 2009 Potesta report addressed to Mr. Crawford.

Do you have that in front of you, sir?

A. Yes, I do.

Q. All right. On the first page of that document, third paragraph, third sentence, the sentence begins, "This cost estimate." Would you read that sentence, please?

A. "This cost estimate has been prepared considering the dynamics of current legislation, capabilities of currently available technology and the company's planned remediation strategy."

Q. Read the next sentence, please.

A. "Installation of treatment systems, as detailed in this valuation, at each of the 78 identified outlets should prevent any enforcement actions under court orders, consent decrees and permits. Potesta believes that water treatment could be required in perpetuity if there are no changes to the current compliance standards."

Q. Turning to the next page, Mr. Schroeder, the last section headed Selenium Remediation Liability Cost Estimate, would you read the first sentence, please?
A. "The cost to remediate selenium was estimated at $390,719,470 gross (adjusted for inflation) or $85,155,374 expressed as a present worth cost. Based on the current state and federal regulatory requirements imposed and implemented under the West Virginia NPDES program and the current best available remediation technology, Potesta believes that this estimate is reasonable."
Q. Can you explain the relationship between the gross number that is identified in that sentence and what is described as a present worth cost?
A. The gross number would represent actual dollars spent at the time you were spending the money. The net or the present worth cost would represent the dollars expressed in current terms, so today, as of today, or as of the date of this report.
Q. Is that sometimes also referred to as a net present value?
A. Yes, it is.
Q. Is that a term that as an accountant you're more familiar with than present worth cost?
A. I'm more familiar with net present value than present worth cost.

Q. Is the net present value a calculation or formula that is understood by accountants?
A. Yes.
Q. Mr. Schroeder, turning now, please, to Joint Exhibit 32, this was the 10-K that was filed by Patriot Coal for the period ending December 31, 2009. Do you have that document in front of you, sir?
A. Yes, I do.
Q. I'm going to ask you to look -- I believe it is on page F-37, Notes To Consolidated Financial Statements.
Can you see if you can find that page, sir?
A. I have page F-37 in front of me.
Q. All right. Looking on the third paragraph of that page, will you read the first sentence, please.
A. "We estimated the costs to treat our selenium discharges in excess of allowable limits at a net present value of $85.2 million as of the Magnum acquisition date."
Q. Does that 85.2 million tie back to the Potesta report that's referred to as a present worth cost?
A. Yes, it does.
Q. Have you continued to rely upon that number in your reporting?
A. Yes.
Q. Turning now to Plaintiff's Exhibit 66, this was the 10-Q that Patriot filed I believe just last Friday. If you can

turn to page 14 of that, do you see a heading entitled General Selenium Matters?

A. Yes, I do.

Q. Would you read, please, the first sentence in the second paragraph of that -- on that page.

A. "We estimated the costs to treat our selenium discharges in excess of allowable limits at a net present value of $101.8 million and $96.0 million at June 30, 2010 and December 31, 2009, respectively."

Q. Mr. Schroeder, if you're expressing a current liability as a net present value, does that mean going forward that that number becomes much greater on a gross basis over time?

A. Yes, going forward you would accrete to a higher number to effectively discount one less period of time. So if it's an annual review, one year to the next year, you would have one year less of present value. So it would grow to a larger number.

Q. Are there other ongoing liabilities that the company reports and that it must manage in addition to the selenium issue that is the topic of this proceeding?

A. Yes.

Q. What are some of those, sir?

A. Retiree health care, Workers' Compensation, black lung liabilities, reclamation obligations.

Q. Mr. Schroeder, Mr. Lovett has questioned you this morning

about the cost of the liquidity and those features in your financial statement that express what the liquidity is.

What does the company do with liquidity? What is its use? That's an open question, but for a non-accountant, can you try to explain that to the Court and to me?

A. Liquidity is effectively the amount of funds that you have available -- that a company has available to use to pay its bills. Liquidity, as I described it to Mr. Lovett, was encompassing cash on hand, plus lines of credit that are available either through the revolving credit agreement or the accounts receivable securitization agreement. All of those add up to something called liquidity, and liquidity is therefore used by companies to pay their bills as they become due, to use to expand operations, to use for capital expenditures, but basically to pay bills going into the future.

Q. Mr. Schroeder, if you know, are the three outlets at Apogee that are the subject of this proceeding part of an ongoing mining operation on that property or not?

A. The three outlets are not part of existing -- are not part of ongoing mining. They relate to mining that has been done in the past.

Q. In order, then, sir, to pay for the treatment of those discharges, whatever that treatment might be, is it necessary for Apogee and other subsidiaries of Patriot to be an ongoing

operation?
A. We certainly need funds from existing operations to pay for costs related to past operations. So I would say this would fit into past operating costs, and therefore we would need current operations to help fund these charges.
Q. Is that equally true of the other ongoing liabilities that you've identified?
A. It would be equally true of the other liabilities that I talked about.
Q. Mr. Schroeder, just very briefly, there were changes in the coal industry and in financial markets generally between 2008 and 2009; is that correct?
A. Yes.
Q. Did that affect Patriot?
A. Yes, very much so.
Q. In what way, sir, just briefly?
A. Briefly--
Q. Do you know if coal prices --
A. The coal industry was very dependent on coal prices. So coal prices in 2008 -- really the mid part of 2008 through about the third quarter were very good for coal producers. And by very good -- I may be getting too detailed here. But by very good, steam prices were well in excess of $100 a ton, and coal, coal referred to as metallurgical coal, was selling for, depending on the quality, in excess of $200 a ton. Those

were very good prices for coal producers.

So during the period up through, let's say, the -- sometime during the third quarter of 2008, those prices were evident.

THE REPORTER: "Those prices were" --

THE WITNESS: Those prices were evident. Around September or October of 2008, as our U. S. economy began to falter, the prices for coal products decreased substantially. By the first quarter of 2009, we had steel producers who use our metallurgical coal telling us that they did not want to receive the coal. They were either trying to cancel their contracts with us or defer deliveries of products from us.

Metallurgical prices in the spot market were dropping drastically. The steam market, which I mentioned was well in excess of $100, moved down into the $50- to $60-range for the same type of coal, same quality of coal. So the coal prices were declining drastically. We had customers who were either trying to get out of contracts or to defer deliveries constantly calling on us.

Our share price, as another barometer, moved from a little bit north of $80 a share in the third quarter of 2008 to less than $3 a share by the end of the first quarter of 2009. So the market -- the coal market moved drastically as the economy in the U. S. moved drastically and we entered a recession.

We also had banks -- I mentioned to Mr. Lovett our revolving credit agreement and the fact that we had a number of banks who were part of that syndication who commit funds to us. The banking industry was in turmoil. We were concerned about several banks that were in that commitment and whether they would continue to be in the commitment or not. Eventually one of those banks, Lehman Brothers, dropped out of our committed funds. We were able to replace them with other banks. But I guess the point there is the financing market was moving quite a bit, as the coal markets were moving quite a bit, as our share price was moving quite a bit.

BY MR. GARDNER:

Q. Mr. Schroeder, did the company -- how did the company, if you can describe this in one or two examples, how did Patriot respond to these changes that you've described?

A. Made a number of changes. I guess a couple that are easily described is shutting down operations. We closed the Jupiter Mine and the Remington Mine, two underground operations that we had, and ended up laying off a number of individuals. We ended up reducing our 401(k) plan. We reduced our capital expenditures, reduced our capital expenditures by a sizable amount.

We were trying to do things through cutting back on the operations side, on the production side, to save dollars both through capital and through operating costs.

Q. Mr. Schroeder, during this time do you know if Patriot continued to install the treatment systems that have been described in these documents that have been given here as exhibits?
A. Yes, we did.
Q. Do you know if you have ever in this time or since 2009 turned down any request for any capital expenditures for research, for the work that CH2M Hill has done, or for anything else that has been requested from the operations?
A. I'm not aware of any.
Q. Do you know if you've approved everything with respect to these items that have come to you for your approval?
A. These generally come in through a budget, an annual budget process, and I would've approved as part of the annual budget process the expenditures for these items.
Q. Mr. Schroeder, just one last thing that I meant to ask you about when we were talking about your K and your most recent Q. In preparation of your Q, do you read the financial -- the publicly available financial reports of other publicly traded companies?
A. I often do, just to look at specific disclosures that they have. Generally if we have similar items, I look at theirs, at least in the section that they would typically have the similar items, to see if, in fact, they describe things the way we describe things.

Q. Do you know if any of your competitors in the Central Appalachian Region that are publicly traded have identified selenium in their public reports?
A. I did look at the 2009 form 10-K of several competitors, Arch Coal, Massey Energy, Alpha Natural Resources, and CONSOL. In looking at all four of those, one of the items I was looking at is to see how they described selenium matters, and I did not find the word selenium. I did a search of their form 10-K filing. I did not find the word selenium in any of those four, except for CONSOL. CONSOL used the word selenium twice, but Alpha, Massey, Arch did not use the word selenium.
Q. Mr. Schroeder, in your most recent Q filed on Friday, do you know how many times you used the word selenium in that Q?
A. We used the word selenium 25 times in the June 30, 2010 form 10-Q. I did -- we did use the word selenium 71 times in the 2009 form 10-K.

MR. GARDNER: Your Honor, I have no further questions.

THE COURT: All right. Any redirect?

MR. LOVETT: Briefly, Your Honor.

REDIRECT EXAMINATION

BY MR. LOVETT:
Q. You say that you've looked at Arch and Massey's quarterly and annual reports for selenium liability disclosures and found none?

A. Yes.
Q. Is it your understanding they have selenium liability?
A. They operate in the same basin that we did, that we do, so I would expect that they would have some selenium liability.
Q. Do you think their failure to include that liability in their quarterly reports constitutes fraud?
A. What I indicated is I have not --
MR. GARDNER: I object to the --
THE COURT: I'm going to sustain the objection. You're asking him to speculate. He doesn't know if they have any --
BY MR. LOVETT:
Q. If a company had a liability for its selenium treatment and that liability were measured in the millions or even tens of millions of dollars and it wasn't disclosed in a financial statement, would that constitute fraud?
A. Materiality --
MR. GARDNER: I'm going to object again. I thought we just covered this.
MR. LOVETT: I thought it was a general question.
THE COURT: I'm going to sustain the objection.
MR. LOVETT: Okay.
BY MR. LOVETT:
Q. Now, I think you said you had not turned down any

proposal from CH2M Hill?
A. I said I did not turn down any request to spend money that Mr. McHale would have forwarded any kind of budget process.
Q. And how much has Patriot spent on its selenium remediation projects over the past two or three years?
A. I don't know the exact amount, but I think you'll probably ask a range, and I would say the range is probably ten to twenty million dollars.
Q. I think Mr. McHale had a different number, a much lower number. So I'll say you don't -- is it fair to say you don't know?
A. I gave you a range. That's the best guess I can give you.
Q. Fair enough. In the exhibit, Plaintiff's Exhibit 65, which is the most -- not the most recent 10-Q, but it's the 10-Q filed on 8/7, 2009, just a several-page --
A. Four or five pages, yes.
Q. Yeah.
A. I have that in front of me.
Q. You have it?
A. I do.
Q. Really the only page that matters on there is page 8, and I've taken you through this before. You say, "Our estimated future payments for selenium remediation average $12 million

each year over the next five years." Do you see that?
A. Yes, I do.
Q. What did you base that on?
A. That was based on the estimate from the Potesta analysis and then further through, I believe, what Mr. McHale put together for us.
Q. Have you spent that much each year?
A. My recollection of the number is somewhere between ten and twenty million dollars --
Q. Okay.
A. -- over the several-year period.
Q. Are you spending $12 million a year on selenium remediation?
A. I don't recall the exact amount.
Q. Is it your belief that you're spending that much?
A. I think we are probably spending in that area, yes.
Q. You say you laid off miners --
A. Yes.
Q. -- and reduced 401(k)s?
A. Yes.
Q. Was your salary reduced during that time?
A. My 401(k) match was reduced; my salary was not.
Q. What is your current salary?
A. $463,500.
Q. And how many -- what did you make in bonuses last year?

A. 2009 bonus, I believe, was 256,000.
Q. Stock options as well?
A. Yes.
Q. How much does a CEO make?
A. I don't know the exact amount, but in the ballpark of 750,000 on an annual basis.
Q. Bonus?
A. I don't recall his bonus amount. Several hundred thousand.
Q. Several hundred thousand? Stock options?
A. Yes.
Q. COO?
A. I don't recall his salary. Somewhere in the 700,000 range.
Q. Bonuses?
A. Don't recall the amount.
Q. I think you said the stock price in 2009 went to $3.
A. Yes.
Q. Is that right?
A. Yes, it did, first quarter of 2009.
Q. That was the time you entered into the consent decree in this case; is that right?
A. Yes.
Q. So you entered into the decree at the time your stock was at its bottom, right?

A. Yes.
Q. And when you entered into the decree, you intended to comply with it, right?
A. Yes.
Q. So you didn't see your stock prices an impediment to that, did you?
A. No.
Q. What is your stock price now?
A. Somewhere in the $12 range.
Q. So it's quadrupled since you entered into -- approximately quadrupled since you entered into the consent decree; is that right?
A. Yes.
Q. What is the coal price today for steam and metallurgical coal?
A. Steam coal is $65 a ton, roughly; metallurgical coal is $160, $170 a ton. It certainly depends on quality and --
Q. Those prices have recovered since the bottom as well, haven't they?
A. Metallurgical, yes; steam, a little, not much.
Q. How much -- how many tons of coal did Patriot mine in 2009?
A. Roughly 33 million.
Q. How many did it mine in 2008?
A. Roughly 25 million, which includes the Patriot operations

for a full 12 months and the acquired Magnum operations for roughly five months.

Q. What do you anticipate mining this year?

MR. GARDNER: Your Honor, I think we're going well beyond the scope of my cross-examination.

MR. LOVETT: The only reason I'm asking these questions is because I understood him to ask the witness about the financial condition of the coal market, the stock market --

THE COURT: I agree.

MR. LOVETT: I'm almost finished. I just want to point out that basically the questions weren't --

THE COURT: Overruled.

THE WITNESS: I think your question was what do we expect to mine in 2010.

BY MR. LOVETT:

Q. Yes.

A. The number is probably in the low 30's; 30, 31 million.

MR. LOVETT: Thank you. That's all.

THE COURT: All right.

RECROSS EXAMINATION

BY MR. GARDNER:

Q. Mr. Schroeder, isn't it true that the company needs to maintain a significant liquidity in order to take it through the peaks and trials --

MR. LOVETT: Objection. That's beyond the scope of my questions.

THE COURT: Well, overruled.

BY MR. GARDNER:

Q. -- that you've just described?

A. Well, liquidity is very important for us; and naturally in my role, I want to see as much liquidity as possible to spend the money that we need to spend on operations, on capital, on liabilities that we have, retiree health care liabilities, Workers' Comp. liabilities, selenium liabilities.

Q. And has the company's liquidity position improved today from what it was a year ago?

A. Yes, it has.

MR. GARDNER: Thank you, Your Honor.

THE COURT: All right. Anything else?

MR. LOVETT: Just one question.

FURTHER REDIRECT EXAMINATION

BY MR. LOVETT:

Q. By liquidity, you need -- one of the things that coal companies need liquidity for is to pay for their environmental obligations, right?

A. Yes, it is.

THE COURT: All right. Any other questions? If not, Mr. Schroeder, you may step down.

Call your next witness.

MR. LOVETT: Mr. Harry Potter.

THE COURT: All right. Mr. Potter, if you'll step over here, my clerk will administer the oath.

HARRY POTTER, PLAINTIFF'S WITNESS, SWORN

THE COURT: Are you going to be using these exhibits?

MR. LOVETT: No, Your Honor. I may use one or two of them. Are these the Court's exhibits?

THE COURT: No, they're not the Court's.

MR. LOVETT: May I take them away?

THE COURT: Yes.

DIRECT EXAMINATION

BY MR. LOVETT:

Q. I'm going to hand you a copy of Plaintiff's Exhibit 3, your CV or resume.

A. Yes. Thank you.

MR. LOVETT: Does the Court have a copy?

THE COURT: Yes.

BY MR. LOVETT:

Q. Would you state your name for the record, please.

A. Yes. Harry James Potter.

Q. Mr. Potter, where do you live?

A. Tulsa, Oklahoma.

Q. And what is your profession?

A. I am a certified public accountant, forensic accountant,

and a certified fraud examiner.
Q. What is a forensic accountant?
A. A forensic accountant is an expert CPA that is involved in reviewing financial transactions and the ramifications thereof for a lot of different purposes.
Q. And I believe you said that you are a CPA as well, right?
A. Yes, I am.
Q. You're also a certified fraud examiner? What is that?
A. Yes. A certified fraud examiner is someone who has background, experience, and training in the investigation of fraud, including financial statement improprieties.
Q. How many certified, if you know, forensic accountants are there in the United States?
A. You know, there's several bodies that certify that. It's in several thousands.
Q. What about certified fraud examiners?
A. I'm not sure in the U. S. That's a worldwide organization, and I believe there's ten thousand, at least five to ten thousand.
Q. And have you appeared as an expert witness before?
A. Yes.
Q. In federal court?
A. Yes.
Q. Have you appeared in West Virginia in federal court before?

A. Yes, probably about five or six times. I was the principal accounting and financial expert in the Keystone Bank failure for the Federal Deposit Insurance Corporation. So I would have testified in front of Judge Faber.

Q. You were the FDIC's expert?

A. Yes.

Q. How long did that trial go on?

A. Well, my work went on for nine years, from 2000 -- the bank failed in September 1999. It went on for nine years, with the last hearing in April 2009.

Q. Any other experience in West Virginia as an expert witness?

A. Yes. I've given depositions and assisted in cases in other -- like accounting malpractice cases.

Q. And were you qualified as an expert witness in forensic accounting in those cases?

A. Well, I just gave a deposition in one case, but I've been qualified as an expert and testified as an expert in financial cases, audit failure cases, failure to meet the standard of care, improper financial reporting cases on many occasions.

Q. Before Judge Faber?

A. Yes.

MR. LOVETT: Move to qualify Mr. Potter as an expert witness in accounting and forensic accounting.

THE COURT: All right. I'm satisfied. Go ahead.

You can cross-examine him as to his credentials.

MR. LOVETT: Thank you.

BY MR. LOVETT:

Q. Mr. Potter, this isn't going to take -- this isn't going to be a long examination from me. I just want to go through several of the points that you've heard from Mr. Schroeder and other witnesses.

Have you been here throughout the hearing?

A. Yes.

Q. And you heard --

A. Well, I stepped out for a couple of minutes, but yes.

Q. You heard Mr. McHale's testimony?

A. Yes.

Q. And you heard Mr. Schroeder's testimony?

A. Yes.

Q. Okay. I think Mr. Schroeder testified that the liquidity of Patriot is approximately $457 million, $437 million.

A. I recall it being over four hundred. I believe it's comprised of cash and then $125,000 receivable securitization program and a $93 million available letter of credit -- a line of credit.

Q. I think you said thousand, but I think you meant 125 million.

A. Yes. I'm sorry.

Q. Which adds up to $432 million.

A. That is my rough understanding, yes.
Q. Okay. And based on that, is it your understanding that it would have sufficient funds to take from those sources to cover a $95 million letter of credit to the Court or escrow payment?
A. Yes.
Q. And did you hear Mr. Schroeder's testimony just now?
A. I heard his testimony now, and I also attended his deposition.
Q. And did you raise any concerns based on his testimony about the impact that a $95 million remediation liability would inflict upon his company?
A. Well, the way I would characterize it, I think anytime most any company would have to write a $95 million check, it would have a little pause and it would possibly have to consider where they were getting the funds and the ramifications from it. But my understanding, based upon his deposition and testimony yesterday and today, is Patriot would be able to do that. And that's also my opinion.
Q. What specific concern did he raise today, if any?
A. His concern today was the -- his concerns dealt with the effect of the financial covenants of the company and as you have more indebtedness, it raises the level of debt in your ratio analysis.
Q. And that's true, isn't it?

A. Yes.
Q. Is Patriot's -- are Patriot's books sufficient to allow you to draw the conclusion that even though it would have that impact, it wouldn't devastate the company?
A. Yes. In fact, you know, I base a lot of my opinion not only on my review of the financial statements but also in my listening to Mr. Schroeder here but also his deposition where he indicated that up to 200 million wouldn't bankrupt the company and actually beyond. You asked him questions beyond that, that, you know, the greater you go, the more effort it takes by the company and the more concern they have to address in various issues, but that's my opinion based upon all that evidence.
Q. Okay. Let me change gears here. Based on what you have seen so far in the hearing and read, do you think that the financial statements that we went through here have materially misstated Patriot's selenium limits -- selenium liabilities?
A. Since they started reporting them, yes. It would have to be -- I believe the first reporting would have been for the June 30, 2009 quarter, which was a disclosure but not an accrual. And from then on out, I would still say that they've been materially underreporting their selenium liabilities.
Q. And you've read the Potesta reports that we've talked about here, right?
A. Yes.

Q. And how do you understand the draft Potesta report to estimate flows?
A. The draft Potesta report estimates flows at 14,040 gallons per minute.
Q. And then there was the final report of July of 2009?
A. Yes.
Q. How did that estimate the flows, if you know?
A. That estimated flows --
THE COURT: Hold on.
THE REPORTER: Repeat your question.
BY MR. LOVETT:
Q. I'm sorry. How did the 2000 -- the July 2009 Potesta report estimate the flows?
A. Specifically for 72 outfalls, it would be 1724 gallons per minute or 12.3 percent of the January '09 Potesta accumulation of 14,040 gallons per minute.
Q. That's because of the use of 24 gallons per outfall as the number for estimating the flows, right?
A. Yes. And I know there's some controversy or some confusion, rather, about how that's calculated, but I referred to Mr. McHale's deposition to make certain that that was an appropriate method.
MR. LOVETT: May I approach, Your Honor?
THE COURT: You may.
BY MR. LOVETT:

Q. Plaintiff's Exhibit 67. It's part of Mr. McHale's deposition in this case.
A. Yes. I believe it's Volume II of it.
Q. Is there something in this statement that leads you to conclude that Patriot based its estimate of liability on 24 gallons per minute at each of the 72 or 78 outfalls?
A. Yes. There's testimony -- you know, it's kind of all the way through here, but beginning in the middle of page 41, at line 13, and ending about line 22 on page 42.
Q. So at line 13, I asked Mr. McHale, "It's my understanding that in the January -- excuse me -- July 2009 report, that you estimated to your auditor that you were going to treat approximately 24 gallons per minute at each outfall." And he responds, "That is what the report assumes."
A. Correct.
Q. And then I asked him, "How many outfalls are there?" And he said, "Approximately 78." Right?
A. Yes.
Q. And then I said, "I've got a calculator here. Twenty-four times seventy-eight equals eighteen hundred and seventy-two. So the July 29th report is based on treating 1872 gallons total; is that right?" Mr. Hurney objected to form. I said, "If you want to do the math, go ahead." And I asked him again, "Are you doing the math?" He said, "Yes." And then he concluded that the 1872 number was correct, right?

A. That's correct.
Q. And then I said, "Isn't it true, then, that the final Potesta report of July 2009 is based on ZVI treatment of 1872 gallons per minute?" He said, "Yes, that's what the number works out to." And then I asked him, "And yet the January 20, 2009 draft report estimate flows at 14,040 gallons per minute." And he said, "Yes." And I said, "And you agreed that that was probably the base flow at the 70-some outlets, correct?" And he said, "Yes." And then lastly I said, "I'll ask you again. Doesn't that mean that the Potesta July 29, 2009 final report is a significant underestimate of the flow that would have to be treated at Patriot's outfalls?" And he said, "Yes."
A. Yes.
Q. Is that part of what you base your opinion upon?
A. Yes, and it's clarifying my analysis of both the January and July Potesta reports. There's a question of whether it's 72 or 78 outfalls, but at 1872 gallons, it's less than 15 percent, I think, of the 14,040 gallons that is estimated to be the base flow.
Q. So from the time of the draft report to the final report, the estimation of flow increased by what percentage?
A. About 85 percent.
Q. And the draft report of January is only calculating base flow to begin with, right?

A. That's correct.
Q. Okay. Now, as I understand, that was prepared for Ernst & Young, Patriot's auditors, right?
A. Yes.
Q. Isn't it important for an auditor like Ernst & Young to have accurate reports from experts to make sure that they reflect the financial position of the company?
A. Yes, it is, particularly in a situation like this. Ernst & Young, like myself, we're not experts in environmental liabilities or professional engineers, but CPAs auditing books often have to take non-financial information and apply it to a reasonable standard to make a determination if the financial information is appropriately stated. So this would be an example of Ernst & Young's reliance upon an expert report.
Q. And therefore the public's and this Court's understanding of the report; is that right?
MR. GARDNER: Your Honor, I'm going to object. And this is something that came up yesterday. I don't understand the relevance of this testimony for the purpose of this case and the purpose of this hearing.
MR. LOVETT: I'm finished.
THE COURT: Well, do you want to respond?
MR. LOVETT: Sure. I'll respond the same way I did yesterday. I think that this is directly relevant because it shows an attempt, a clear and a conscious attempt by Patriot

to underestimate its liabilities before this Court and before the public generally starting back before the entry of the consent decree, starting at least at the time of the first hearing in this case in July of 2008 and progressing in a systematic way forward to deceive shareholders and the Court and us, the plaintiffs, about what the liabilities of the company were and to make its case that it wasn't able to pay for its treatment.

MR. GARDNER: Your Honor, with all due respect, that is not what this testimony has been about. Now, Mr. Lovett said yesterday when I raised this very point that he agreed this is not a securities case, that this is a matter that arises under the Clean Water Act. The company has not pleaded poverty. It has not pleaded an inability or an unwillingness to address this liability and to spend the money.

Mr. Schroeder just testified a few moments ago that the company, despite a difficult time, had continued to do exactly what it represented it was going to do before this Court two years ago. So I don't understand where this is going.

THE COURT: Well, I deny the objection. As I think I indicated yesterday, obviously a central issue in this hearing is to determine whether or not the defendant is in contempt. And part of that certainly includes consideration of the effort undertaken by the company to conduct the proper environmental remediation at these sites. And this testimony

I think is directly relevant to the effort of the company to understand its liability and responsibility and the steps that they took to remedy that.

I'm certainly not at this point reaching the conclusion that Mr. Lovett is arguing here, that there was perhaps some level of fraudulent misrepresentation by the company in these reports. But certainly the company's understanding of its liability, how they characterize that responsibility during this period when they're under this consent order is directly relevant to the question -- to the central question before this Court, and that is, is the defendant in contempt, has the defendant made a reasonable effort to comply with the Court's order. So I overrule the objection.

MR. LOVETT: Thank you, Your Honor.

THE COURT: Are you finished with your questions?

MR. LOVETT: That's all I have.

THE COURT: All right. Cross-examination?

CROSS EXAMINATION

BY MR. GARDNER:

Q. Mr. Potter, good morning.

A. Good morning. How are you doing?

Q. Welcome back to West Virginia, sir.

A. Thank you.

Q. Mr. Lovett has had a brief direct examination of you and I'll try to keep my cross-examination similarly brief. First

of all, I did want to ask, your certifications as a forensic accountant and a fraud examiner, who does those certifications? What body?

A. My certification as a forensic accountant is from the American College of Forensic Examiners, and my certification as a certified fraud examiner is from the American Institute of Certified Fraud Examiners, I believe, American College of Certified Fraud Examiners.

Q. What is that group?

A. That is a group that's been now around since the early '90s -- I got my certification in '97 -- that is really a leading force in terms of training and aggregating professional resources in its headquarters in Austin, Texas, and it's very well-recognized.

Q. But it's not a state licensure or something done through the financial accounting standards board or anything like that.

A. No. It's a private organization actually that arose out of the need to try to address the burgeoning amount of fraud in the United States.

Q. Thank you. Mr. Potter, as I understand the questions that Mr. Lovett has asked you, he had asked if the company were required by the Court to both undertake treatment beyond what it has reported and then to provide some additional financial mechanism in effect to guarantee that performance,

whether that would affect the company's liquidity.

Do I understand that you believe it would affect the liquidity?

A. Oh, certainly.

Q. It would?

A. Yes. And somewhere, you know -- if you narrowly defined liquidity as being your available cash and your available borrowings, it certainly will affect liquidity.

Q. And I think you said that you heard Mr. Schroeder's testimony. You understand the purposes for which a company's liquidity is important, especially in a business such as the coal business?

A. Yes.

Q. Do you agree that in order for Patriot to undertake the liabilities that are at the heart of this proceeding, that Patriot must be an ongoing entity financially?

A. You know, if Patriot were to go bankrupt, that would open up -- it would make it more difficult. As we all know, bankruptcy is a very expensive process that can result in a lot of uncertain outcomes. It would certainly be preferable if Patriot remained an ongoing entity and it would be better, yes.

Q. So you don't find bankruptcy a desired outcome in this proceeding, do you, sir?

A. No, but I recalled Mr. Schroeder's deposition where he

indicated 200 million would not bankrupt the company. So I'm not testifying about a monetary amount, but I don't really see bankruptcy flowing as an option of this proceeding, but I could be wrong.

Q. You haven't offered any opinion in this case about fraud, have you, Mr. Potter, because I was at your deposition? Did I understand you in that to -- that you expressed any opinion about fraud from your examination of these documents?

A. No, I haven't expressed an opinion, and I think in my deposition I specifically said I haven't looked at the audit work papers to know what was given to Ernst & Young, and I haven't expressed such opinion.

MR. GARDNER: One moment, please.

Mr. Potter, thank you. No further questions.

THE WITNESS: Thank you.

THE COURT: All right. Any further questions?

REDIRECT EXAMINATION

BY MR. LOVETT:

Q. One of the purposes of posting a letter of credit or an escrow -- creating an escrow account would be to assure that this liability was discharged even if there was a bankruptcy, right?

A. Yes, that would effectively guarantee that.

MR. LOVETT: Thank you. Your Honor, I'd move to admit the exhibits from Mr. Schroeder, which I neglected to do

after his testimony, and Mr. Potter's as well.

THE COURT: All right. Any objection?

MR. GARDNER: No objection.

THE COURT: All right. All the exhibits will be admitted.

All right. Any other questions, Mr. Gardner?

MR. GARDNER: No, Your Honor. Thank you.

THE COURT: All right. Mr. Potter, you're excused.

THE WITNESS: Thank you very much.

THE COURT: Are any of these papers yours?

THE WITNESS: No. I think they were --

THE COURT: All right. Counsel?

MR. LOVETT: Can I retrieve them, Your Honor?

THE COURT: Yeah. How long is your next witness going to take?

MR. LOVETT: I would guess 40 minutes.

THE COURT: All right. Let's go ahead and take about a ten-minute recess.

MR. MCLUSKY: Your Honor, I wanted to figure out the order of witnesses.

THE COURT: Yeah, why don't you tell them.

MR. MCLUSKY: We have some here at 1:00. Would that be sufficient --

MR. LOVETT: We have one more witness. My guess is 40 minutes on direct, thereabouts.

THE COURT: Who is that?
MR. LOVETT: An economist, Dr. Kavanaugh.
THE COURT: He's been deposed, I take it?
MR. GARDNER: He has been.
THE COURT: Any idea how long your cross is going to take?
MR. GARDNER: Potentially not a long time, Your Honor.
THE COURT: I'm sorry?
MR. GARDNER: Potentially not a long time. Thirty minutes, perhaps.
THE COURT: All right. Well, that will probably get us pretty close to a break anyway. So I think if you've got people coming at one, that's fine.
MR. GARDNER: Thank you, Your Honor.
THE COURT: All right. We'll take a ten-minute recess.
(Recess from 10:17 a.m. to 10:30 a.m.)
THE COURT: All right. Are you ready to call your next witness?
MR. TEANEY: Yes, Your Honor. Plaintiffs call Dr. Mike Kavanaugh.
THE COURT: All right. Doctor, if you'll step up here, my clerk is going to administer the oath.
MIKE KAVANAUGH, PLAINTIFF'S WITNESS, SWORN

DIRECT EXAMINATION

BY MR. TEANEY:

Q. Good morning, Dr. Kavanaugh.

A. Good morning.

Q. Can you spell your last name for the record, please.

A. Last name is Kavanaugh, K-a-v-a-n-a-u-g-h.

Q. Thank you, Doctor. Where do you live, Dr. Kavanaugh?

A. Could you repeat that? I can't --

Q. I'm sorry. I talk too fast sometimes. Where do you live?

A. I live in Volcano, Hawaii.

Q. What time is it in Hawaii right now?

A. It's six hours before us, so it's late morning. 4:00 a.m., 4:30.

Q. Thank you very much for coming out here and --

A. It's a pleasure.

Q. -- enduring the time change. What is your occupation, Dr. Kavanaugh?

A. I'm a research economist.

Q. I have a copy of your curriculum vitae. It's been marked and provided to the Court as Plaintiff's Exhibit 2.

May I approach, Your Honor?

THE COURT: You may.

BY MR. TEANEY:

Q. Dr. Kavanaugh, is this a recent copy of your resume or

CV?

A. Yes, it is.

Q. Excellent. Where did you do your undergraduate work, Dr. Kavanaugh?

A. I did undergraduate work at Xavier University in Cincinnati, and I did my graduate work at the University of Cincinnati.

Q. Did you obtain a doctorate degree?

A. Yes, I did, 1975.

Q. And what was the subject, or what was the area?

A. Economics.

Q. Economics. Have you appeared as an expert witness in an environmental case before?

A. Yes, I have. The last two pages of my -- three pages of my resume set out when I've testified in federal court and my deposition testimony since 1991. There have been some cases prior to 1991, but I have lost track of them and just report since 1991.

Q. Understood. As I'm looking at this, a couple caught my eye because they occurred here in the Fourth Circuit. One is them is *Friends of the Earth v. Laidlaw*.

A. Yes.

Q. Did you testify in that matter?

A. Yes, I did. I testified --

Q. Was that -- I'm sorry. Go ahead.

A. I was deposed and I testified in court. There were two hearings in the *Laidlaw* matter, and I testified in both of those hearings.

Q. And what court was that?

A. That was in Columbia, South Carolina federal court. It was a Clean Water Act case brought by citizens who were seeking enforcement of a Clean Water Act permit held by Laidlaw, and --

Q. What opinion did you offer or were you asked to give in that case?

A. I was asked to opine upon the economic benefit that the defendant Laidlaw enjoyed by its failure to comply with the Clean Water Act.

Q. Do you recall what pollutant was at issue in that case? Do you recall what pollutant was at issue in that case?

A. Well, there were several. It was an incinerator, and they collected waste from a number of sources and would bring it to the incinerator and burn it. Water was part of the process, and so there were a number of pollutants. The major concern was mercury, which was a significant risk to human health. And that was, I think, what you would call the major pollutant, but there were others as well.

Q. Did that case ultimately reach the Supreme Court of the United States?

A. It did. It did. It was -- the plaintiffs -- there was a

finding for the plaintiffs at the district -- at the district level. The appeals court reversed, and then the Supreme Court reversed on that. Most of the appealing had to do with issues involving the standing of citizens to bring actions in federal court under the Clean Water Act statutes.

Q. Another case on your resume that caught my eye was *Friends of the Earth v. Gaston Recycling*. Did that case also take place in the District Court of South Carolina?

A. Yes, it did. It was similar in time to when *Laidlaw* was also going forward, but that was more coincidence of scheduling. They were not unrelated cases. And there was some preliminary work on that, and I don't know if there was a settlement or if *Gaston* just disappeared, and it just never really came to a complete resolution.

I had a call years later, more than five years later, asking if I still had some material from *Gaston*, that there was some motion. And I had not archived the material. So I don't know whatever happened.

Q. What were you qualified as an expert to testify about in *Gaston*?

A. Again, it was on the economic benefit enjoyed by the defendant for not coming into compliance in a timely manner.

Q. Okay. Another interesting case -- or I'm sure all of these are interesting, but one that caught my eye again was *U. S. v. Rapanos*.

A. That was a Clean Water Act case brought by the United States against a gentleman who was developing property in Midland, Michigan and filling in wetlands without getting a permit; and I, again, opined as to what the benefit was to Mr. Rapanos for his failure to get a permit to fill the wetlands, and --

Q. Who retained your services in that case?

A. Excuse me?

Q. Who retained your services?

A. The United States. The case was brought by the United States Department of Justice, and I was testifying on behalf of -- they called me to the stand and asked me what my opinion was about economic benefit.

Q. Did that case ultimately reach the Supreme Court of the United States?

A. Yes, that reached as to whether or not the extent to which wetlands were, if I understand it right, waters of the United States; and if the wetlands were intermittent, was that a -- how much of a factor was that on whether they were waters of the United States. Again, an odd standing issue.

Q. Certainly. So those are three cases that caught my eye. Do you have an estimate of how many times you've been qualified as an expert in economics to address economic benefit?

A. Every time I've been called I've been qualified as an

expert in economic and financing in that case. I would say more than 20 times.

Q. Is your work always with plaintiffs or do others retain your services?

A. It's primarily with plaintiffs. I have worked on behalf of defendants, have been retained by defendants. I have never taken that all the way through to deposition testimony or trial testimony. Often my involvement with defendants is in trying to get the parties to settle their differences among themselves. And I can -- if I can, I like to narrow the differences between the parties so that an agreement can be reached.

MR. TEANEY: At this time, Your Honor, plaintiffs would like to move to qualify Dr. Kavanaugh as an expert in economics and on economic benefit resulting from non-compliance with environmental laws.

THE COURT: All right. I'm satisfied. You can go ahead.

MR. TEANEY: Thank you, Your Honor.

BY MR. TEANEY:

Q. Dr. Kavanaugh, let's start kind of at a general level and we'll try to funnel down a little bit here.

Can you explain for me the concept or the notion of delayed costs when it comes to environmental compliance?

A. Yes. Generally, as a general matter, in order to comply

with this country's environmental statutes, spending has to occur. That spending is usually divided into two parts, spending that is for capital equipment and spending that is for operating and maintaining the capital equipment.

The concept of delayed costs are -- is that if you fail to come into compliance in a timely manner, what you have done is you have delayed some capital spending. You should have been in compliance in year one, you didn't come into compliance until year five, that you've delayed the spending of that capital.

That is often contrasted with avoided spending, in which you should have been in compliance in year one, plus in year two, three, four and five, and you would have had to pay operating and maintenance expenditures during those years. For the capital expenditures, you simply delay. You should have spent it in year one, but you spend it in year five. You actually do make that expenditure, or the equivalent of that, just five years later. But with the avoided expenditures for O&M, once you have avoided them, once the passage of time prevents you from ever making up that spending, so that's money that goes to you and you keep; whereas, in the former case, the delayed, what you get is the opportunity to use those funds for a period of time until you actually make the expenditure.

Q. Thank you. There's a couple of things I want to touch on

there. First, with regard to operation -- operating and maintenance costs you described as avoided, in a hypothetical if a polluter had a deadline to comply by April 5, 2010, here we find ourselves hypothetically in August 2010, would that polluter have some avoided operating and maintenance costs?

A. Yes.

Q. Have you been asked to measure those costs in this case?

A. Not exactly, no.

Q. Okay.

A. I have -- I have reviewed engineering documents trying to determine what the operating and maintenance costs might have been but never came to a conclusion or opinion as to what they would have been had the proper equipment been in place at the proper time.

Q. And you weren't asked to prepare that opinion; is that correct?

A. That's right, I did not.

Q. But with regard to calculating, you know, I guess -- I believe you used the term opportunity cost or opportunity. How would you calculate or determine -- what method would you use to determine what the avoided costs were or what the opportunity cost was?

A. Yes. I would take a fairly basic principle and apply it. I would, first of all, seek out what the costs -- what costs should have been spent in order to come into compliance and

when they should have been spent. And then I would value those costs in terms of their present value by taking into account that the funds made available by a failure to comply are available to a business organization to invest in its company or to operate its company. And those funds have an opportunity cost.

So I would take the amount avoided, plus their opportunity cost during that period of time to which they were avoided, and that combination would provide an estimate of the benefit enjoyed by the firm for avoiding operating and maintenance costs from one period of time to the next.

Q. And how would that method -- would it be similar to calculate the delayed costs?

A. Well, the difference in the delayed costs is that the firm will eventually make the capital expenditure. It should have spent a million dollars in year one; it doesn't get around to spending the million dollars until year two. So they've had the use of a million dollars for a year. And I would figure the benefit on the opportunity cost of a million dollars to that firm; whereas, if it was an avoided expenditure, it would be a million dollars, plus the opportunity cost, but because this is just a delayed expenditure, it's the opportunity cost on the million dollars.

Q. I understand. Let's make it a little more concrete. How would you determine the opportunity cost for a coal company?

A. Well, it wouldn't matter what the industry was. It would matter what costs were avoided or delayed. I would then want to see if I could come up with an opportunity cost that was applicable to the company. And without having to go into a lengthy investigation, I tend to use either other -- results of other investigations or a more general default value applying by standard models tools of economic and financial analysis to find the equity cost of capital or the weighted average cost of capital and use that figure as a way of estimating the opportunity cost for that company.

So if it's a coal company, if I had something specific for the coal industry or a coal company, I would take that into account in arriving at an opinion as to what the proper opportunity cost to apply to a coal company.

Q. Do you have an opinion as to an appropriate opportunity cost for Patriot Coal Company?

A. I have formed an opinion on that. I think that the -- I formed the opinion by reading some documents that were prepared by an independent firm, Duff & Phelps, as part of the valuation of the Magnum assets when Patriot acquired them. I believe it was Mr. Schroeder was describing the need in purchase accounting to make an estimate of the value of what they purchased, and they had retained a firm to produce that estimate.

I read that report. And in that report, Duff & Phelps

also had need to come up with estimates of opportunity costs, and they produced several estimates, and I thought that the work was convincing and that for an equity cost of capital, they were using about 14 percent, and for a weighted average cost of capital, it was about 13 percent. And I read around and did some other calculations around that.

I was convinced that the Duff & Phelps had some credibility to it and was applicable to Patriot since it was produced with Patriot in mind and settled on the lower of the two of 13 percent.

Q. What is the result of using the lower of the two?

A. Well, if you were doing an economic benefit calculation, it would put down with pressure on the economic benefit. Everything else equals as opportunity cost declines, the benefit would decline.

Q. Understood. Have you reviewed some of Patriot's financial documents?

A. Yes, I have.

Q. Have they used a discount rate to bring their selenium liabilities to a present value?

A. Yes, they have.

Q. And what rate did they use?

A. They disclosed in their filings with the Securities and Exchange Commission their 10-K, their 10-Q, and in the prospectus that accompanied their issuing of senior notes of

May of this year, they used a rate of 13 percent.
Q. And that's the same as the weighted average cost of capital --
A. Yes --
Q. -- that Duff & Phelps concluded?
A. -- that's right. The basis of the number 13 percent is -- goes back to a -- the Duff & Phelps report; and in that report, Duff & Phelps made an estimate of the weighted average cost of capital and found that to be 13 percent.

In producing that estimate of the weighted average cost of capital, they had to make an estimate of the cost of equity. And the cost of equity in that case would have been 14 percent.

I often move towards the notion of using an equity cost more than a weighted average cost of capital. And the reason I do that, it was, I think, sort of stated by Mr. Schroeder when he pointed out that there are no more cash flows coming from Apogee. So anything that you're going to have to do at Apogee is going to be supplied mainly by equity. It's going to cost the company equity to fix Apogee. And using a weighted average cost of capital, which includes both equity and debt, tends to understate -- would tend to understate the benefit to the company from delaying fixing Apogee.
Q. Understood. Have you come up with a method to calculate what the economic benefit to Patriot would be for further

delay in fixing the problem at Apogee?
A. Yes, I have. I've tried to modify the standard way that we calculate economic benefit to adapt it to the situation that we have here where we're just looking forward, not looking backward. In a regular economic benefit analysis, not only would you stand at this point and look forward about when Apogee or Hobet will come into compliance, but you would also look back and say, well, they should have been in compliance either as some statute of limitation date or when the permit came out or when you got some sort of summary judgment determination, but you would look back in time.

What I did for this case was to only look forward, and the past became irrelevant. So it is different. My calculations for this case are different than the standard economic benefit analysis in that it doesn't look back.
Q. And when you describe a standard economic benefit analysis, is the typical use of that analysis to calculate civil penalties in an environmental proceeding?
A. Yes, that's the use. The civil penalty has several components. Economic benefit is one of them. And the purpose of the economic benefit calculation is to put the defendant in the same financial position had it complied, and then to that economic benefit is added amounts for punishment or for whatever else justice may require is the way to go. That's a lot of discretion. But the economic benefit is more narrow.

It's a component of the civil penalty.
Q. But in this case you're only looking, in the modeling you've done --
A. Because I'm just going forward from the date of -- from an assumed date of when the order may come and that tells Apogee what it must do.
Q. Okay. I have an exhibit that I would like to use to talk about and walk through this model in your calculations. This has not been previously provided.
May I approach?
THE COURT: You may.
MR. TEANEY: Thank you. Can we mark this? I believe it's Plaintiff's 68. I have an extra copy for the Court.
THE WITNESS: Can you get me some water?
MR. TEANEY: Yes.
BY MR. TEANEY:
Q. Dr. Kavanaugh, do you recognize these pages?
A. Yes. I prepared these.
Q. Thank you. And what software program did you use to prepare these?
A. I used a spreadsheet program produced by Microsoft. I believe its version is Excel. I don't know the number that goes with it, but it should run on anybody's computer.
Q. Understood. And would you use the word model to describe

this application?
A. Yes. I've tried to make a very flexible model of what I would call a fine that would provide an incentive for the company to comply; and it's set up so that if the company complies, the fine is zero. And as the company either doesn't comply either by stretching the time out over which it spends money or doesn't spend enough money to fix the problem, then part of -- then the fine goes up. As the delay goes on, the fine goes up. As the amount of money not spent that it should have spent increases, the fine goes up until it reaches its maximum.
Q. Thank you. I think I want to talk about the second page that I handed you first, and I probably put them in the wrong order. And we'll start with this and talk about some of the -- I'll use the word inputs --
A. Okay.
Q. -- that go into the model. Well, let's start with a basic question. Why are there four columns of numbers here? What do these four columns represent?
A. One of the large tasks that I had to look at was how to characterize what it is they're going to do, and I came down that they are going to spend money over a period of time, and I wanted to break the period of time up into parts so that we have four milestones. So whatever the length of the project turns out to be, or however much it's going to cost, I divided

into four equal time periods. And at the end of those time periods, in my mind, in my conception of the problem, you take a look and see what has happened. Is the project on schedule? Have the agreements been made -- kept that have been made?

And at that time, you calculate a maximum fine and determine how much of that fine should be purged for the effort that the company made.

Q. Okay. So I just want to make sure I understand. If the time period were one year, then these columns would equal what's commonly called a calendar quarter or --

A. Yes, that's correct.

Q. But if you go to a two-year schedule, you're now -- your quarters are six months; is that right?

A. That is right.

Q. Okay.

A. And it is flexible enough so that if you go to some odd number like 28 months, then you just divide it up into four 7-month periods, which is neither a quarter nor a half.

Q. Right.

A. But it is that -- that's what I wanted to -- the point I think is that there is flexibility in the model to accommodate different opinions about how long it's going to take.

Q. Understood. And so that brings us -- I'll look down here to -- on this page, it says 900 and then incremental days delayed.

A. Right.
Q. And then in each quarter, it's 225, 225, 225, 225. What does this 900 represent?
A. Nine hundred is the length of time for the project, nine hundred days.
Q. Okay.
A. I used a 360-day financial year. So 900 divided by 360 would give you the length of time in years. That's going to be roughly two and a half years it looks like.
Q. And this 900 is one of the inputs --
A. Yes, it is.
Q. -- that you put in there?
A. Yes, it is.
Q. Okay. Let's say it were two years. We'd put in 720 days?
A. That's correct.
Q. And then when you input it there, does your model automatically sub-divide the total number of days into four equal parts?
A. Yes, it does.
Q. Okay. And so in this case, the 225 over here represents the number of days in the quarter based on a 900-day schedule.
A. That's correct.
Q. Okay. All right. Let's go back up to the top here, and can you explain what the fractions here, .25, at the top of

each column represent?
A. Once I decided that we're going to look at the project in four steps, then I had to --
THE COURT: Use the microphone.
THE WITNESS: -- then I had to determine how much is spent in each quarter. Twenty-five across the top means that spending is equal across each quarter, that if we had a million-dollar project, you'd spend $250,000 in each quarter.
The model, though, is flexible enough that if you hit another spending pattern that would be easier to do -- and I believe that's what was showing on the second page that you gave me --
BY MR. TEANEY:
Q. Yeah, okay. But if we could compare those really quickly, I guess that since these are percentages, the sum of the four quarters should be one.
A. Yes, that's right. The sum across of those four numbers should equal one or one hundred percent.
Q. And so in the case of the first page that we were discussing, the .25 times four obviously is one. What do we have here on the second page?
A. What you have on the second page is a plan of spending in which in the first quarter you just do 15 percent of the work, through the two middle quarters you do 70 percent of the work -- first, 30 percent, then you build up to 40 percent --

and then you have some wind-down of 15 percent in the fourth quarter. So it's not equal, but it's more of a lump, more rounded.

Q. And so your model is flexible in that you can assign different percentages to each quarter.

A. That's right. If you can come to an agreement among the engineers and others about the pattern of spending, you can take that into account.

Q. In your -- let me take a step back and ask you a couple of questions about how you've calculated it, how you come about calculating economic benefits in other circumstances.

Do you often work with engineers and rely on their statements about -- in your creation of these models?

A. Yes. Yes. Natural resource and applying economics to environmental matters requires you to read some engineering documents and obtain -- be a little bit conversant, that environmental statutes in the United States are -- a lot of them are based on engineering and engineering feasibility, and you need to be able to communicate with an engineer to do the work.

Q. So in forming your expert opinions --

A. Yes.

Q. -- you often rely on statements from engineers?

A. Yes.

Q. Okay. Now, let me ask you, where did you -- why did you

input .15, .3, .4, and .15 --

THE REPORTER: I'm sorry.

MR. TEANEY: I apologize.

THE REPORTER: Start over again, a little bit slower.

BY MR. TEANEY:

Q. I'd be happy to. Why did you input here on the second page .15 in the first quarter, .3 in the second quarter, .4 in the third quarter, and .15 in the fourth?

A. I had a conversation with Dr. Koon about what his experience was, how spending in environmental projects go, whether -- I was at the point in building this model that if I divided it up into quarters, but then how did I divide the spending up. I divided the time up, but now I needed to divide the money up. And so I was asking Dr. Koon about that. And at the end of the conversation with him, something that looked more like a lump than like a line was appropriate. And that's where the 15, 30, 40, 15 came from.

Q. Okay. Thank you very much. Working down to the next input line -- I'm sorry. That first one is called pattern and milestones; is that right?

A. Right. That sets out the pattern of spending and the milestone amounts of money that you would anticipate spending.

Q. Okay. And so the next line here, we have ordered amount. And in the examples that we have before us and that the Court

has before it, there's a million dollars in there.
A. Right.
Q. Why did you put a million dollars in there?
A. It's because I didn't know what other number to put in there. There was disagreements, varying opinions. There were varying opinions about what it was going to take to fix the problem, and I didn't know, and I became convinced that I would not know. So in order to make it more useable, I tried to take a number that was easily scaled, and one million seemed to be an easily scaled number.
Q. So you could take the product that a million tells you and multiply that by the number of million dollars that is ultimately ordered to calculate the fine?
A. Yes.
Q. Okay. And when you said there were varying opinions on the cost, whose -- what varying opinions are you talking about?
A. I read through different engineering reports produced by CH2M Hill. There was one from a firm out in the Bay Area. There were different technologies, ABMet, DSL, ZVI. I just -- not an engineer, didn't want to go that far, didn't think I was going to get an answer to the number that would be agreed upon, and so I used the million.
Q. And so the varying opinions, then, were in the record in this matter that you've been provided?

A. Yes.
Q. Okay. Thank you. Okay. So we've got the ordered amount. And for ease of calculation, now that we understand what the numbers on the top row meant, let's look at the one that does it in quarters, just because it'd be easier to talk about, because these columns are all the same. Because you've got a million dollars, in the first quarter they're expected to spend $250,000?
A. That's correct.
Q. Okay. And the same throughout, since this is a level pattern of spending.
A. Yes.
Q. Okay. Now, the next line down, under ordered amount, is credit for effort.
A. Correct.
Q. What do you mean by credit for effort?
A. That is the amount of money that you think the defendant's actions are worth in executing the project. If the project's first quarter you expected to see plans and some grading and $125,000 for plans and $125,000 for grading and at the end of the first quarter, as your milestone came up, you found out what they did and they only had the plans, so you give him $125,000 for their plans but no effort for grading. So you give him $125,000 credit, but that would be it.
If they had neither plans nor grading, it would be zero.

And if they had both, you'd put in 250,000.
Q. So it measures the level of effort that --
A. Yes.
Q. -- the defendant expended during the time period?
A. Yes.
Q. Now, is this model -- this version of the model as it was run, was there a zero credit for effort given?
A. Yes.
Q. Okay. And that was to show how the fine increases across the time period?
A. Yes.
Q. Okay. If the fine were purged -- or let's say they did the plans and the grading, using your example, what happens to the fine?
A. It's purged.
Q. And so it goes to zero?
A. It goes to zero.
Q. Okay. All right. Let's go back to the scenario where, you know, this particular polluter went to Florida or something and didn't do anything in the first quarter. We go down to the number of days delayed. We understand that that is the 25 percent of the total days. And then we've got this rate.
A. Right.
Q. And what is this rate?

A. Okay. That is -- we start with the opportunity cost rate of 13 percent. That is the rate for a year. Our quarter in this instance is only 225 days. So it's only a part of the year. So it's 225 divided by 360 times the opportunity cost rate, and that tells you that the opportunity cost rate for this quarter of the project is 8.1 percent.

Q. Understood. If the project, instead of 900 days, were, say, 800 days, would the rate calculated per quarter change?

A. Yes. It would decrease.

Q. Would it change significantly?

A. Not a lot, no. It would go from a 225 day rate to a 200 day rate in your example.

Q. Okay. All right. So then the next line is the incremental fine. What is that and how does your model determine that?

A. Okay. The model determines that -- that's determined by taking the 8.1 percent and multiplying it by the amount of money that was delayed, which in this example was $250,000. And that's the maximum fine for that quarter of the project. And that comes out to be 20,313 in the example.

Q. And does the model tell you what that is on a daily rate or the equivalent of a daily rate?

A. Yes. I also calculate that as a daily rate. I found in our discussions that people thought in terms of a daily rate. I didn't see a daily rate being -- a fine being applied every

day, but I saw that there would be some period at the end of that quarter, if the quarter had 225 days in it, then you would pay a daily rate for those 225 days. And people were thinking in terms of that, so that's why I started to express it as a daily rate.

Q. And in this case, what is the daily rate, the effective daily rate in the first quarter?

A. At this stage I have just been making the calculation without what I'm calling a margin of safety. So without the margin of safety, it's $90 a day. That's for avoiding a million-dollar -- that's a million-dollar project. So if we had a $100-million project, it would be 100 times 90, or a $9000 day rate, but then the project would be so much bigger than this 1 million.

Q. Understood. And just to be clear, this is only calculating the economic benefit on delayed costs; is that right?

A. Yes, that's correct. There's no avoided O&M involved in this at all.

Q. Understood. Well, you mentioned a margin of safety. What is the margin of safety here in your model?

A. To this stage in my explanation of the model, this is designed to make the company indifferent in financial terms, indifferent between complying and paying the fine. I wanted to tip the balance and not make the company indifferent

between the fine or compliance, and so I added a 10 percent charge to make it more financially attractive to comply rather than pay the fine.

Q. So the margin of safety is to motivate the company to perform rather than treat it as a -- treat the fine as a cost of doing business.

A. Correct.

Q. And you said you used 10 percent?

A. Yes.

Q. Okay. And so looking here, you've got the equivalent daily rate max of 90. The bottom line says $99 per day. That's the daily rate with the margin of safety, 10 percent.

A. Correct.

Q. Okay. So that's how we walked through the first quarter. And looking at the second quarter, these numbers are going up. It looks like in this case they've gone up by 90 and change. I'm looking at the daily rate.

A. Yes.

Q. Can you explain why they've gone up and what that means?

A. Sure. In this example that we have before us, there is no credit for effort. So at the end of the first quarter, they paid a fine. They have then moved on to the second quarter where they are now having to spend not only the 250,000 that they failed to spend in the first quarter, but they have to also be spending the money that they were

supposed to be -- taking up the projects they were supposed to do in the second quarter. So if you go from planned and grading to purchasing equipment, then that's what all has to happen in the second quarter. They've got a lot of catch-up to do.

And in this example, we have them not doing anything again. So they owe for the first quarter. The first quarter that they didn't do the first time was paid for, but they still have the first quarter to do, and now they have the second quarter to do. So the fine is roughly twice what it was. They're now 450 days behind. They're now $500,000 behind. So the fine is going to have to increase to reflect that, and it does.

Q. And so they have then -- you know, in the first quarter, they would have enjoyed the economic benefit of 250,000. Is this another way of saying what you did?

A. Yes, that would be another way of saying that.

Q. And in the second quarter, they enjoy the economic benefit of $500,000.

A. That's right.

Q. Okay. Now, let's assume that they did everything they were supposed to do in the first quarter. If you were to enter, you know, credit for effort, $250,000, if you entered that in the first quarter, what effect would that have on the fine in the second quarter?

A. Well, that would make the fine on the second quarter smaller. If they did the first one, then quit, then their fine would be looking more like the fine in the first quarter, because they delayed the same amount of money for the same amount of time.
Q. Would it, in fact, be the same?
A. It would be the same.
Q. Okay. All right. I have tried to explain every -- or work with you to have you explain every element here on the model. Let me ask you, have I overlooked anything?
A. I don't think you have. I think it's a tool. I see it as a tool for coming up with a way of making an incentive, using fines as an incentive to achieve compliance.
Q. In your opinion is this model so easy to use that even a lawyer could do it?
A. I have seen lawyers become very proficient with it.
Q. Thank you. I want to move on to another subject matter, but I would -- let me go ahead and move on to another subject matter.
A. Okay.
Q. And that has to do with financial assurance. What do you understand the concept of financial assurance to be?
A. Financial assurances is a concept that it's part of the environmental statutes certainly in Resource Conservation and Recovery Act, certainly in Superfund. It's when you require

financial assurances that an order or a task or an obligation is fulfilled.

Some of the very early ones were building trust funds to take care of liabilities at waste -- at solid waste sites so that after the solid waste site is closed, there's still money available to make sure that that waste doesn't leach into groundwater.

The concept has grown now so that financial assurances are found to accompany a number of different orders for relief to make sure that it happens, the relief happens. And there are several ways to provide those, and they can be very effective in seeing to that the work ordered is the work that gets done.

Q. Is a letter of credit one method of financial assurance or one instrument?

A. Yes. Yes, it is. It has several advantages. It can survive bankruptcy. It is fairly easy to administer. It can be very low cost depending on the company's ability to provide collateral. It's a proven instrument. So it has a number of advantages.

Q. Is an escrow account another method?

A. An escrow account is another way. Escrow may or may not survive bankruptcy, it's more expensive but is -- all the money is there immediately.

Q. Would you ever pair the two in some way?

A. You could pair the two. You could require immediate establishment of an escrow account, and you could then release the funds from escrow when letters of credit equal to the escrow are obtained. So if there is some problem or delay in obtaining letters of credit, an escrow account would do -- would fill that void, that delayed -- that administrative lag in getting the letters of credit written. During that period of time when nothing was -- when the letters of credit had yet to come in hand, you could have an escrow account.

Q. And would that escrow account provide a motivation to the party to obtain a letter of credit?

A. I think that it would, because a letter of credit is less expensive. The opportunity costs of a letter of credit are far -- of a given amount are far less than the equivalent cost of an escrow account.

If I have a $10 million escrow account, I'm losing out on $10 million. If I have $10 million worth of letters of credit, it's just the cost of the letter of credit, which is a small fraction of its face value. So it's financially advantageous to have -- from the point of view of the defendant to have letters of credit as a substitute for an escrow account.

Q. Are there benefits to a plaintiff as well of a letter of credit?

A. Oh, the plaintiff is the one who is being assured here.

No more are you -- that the money -- the cost of the order is -- becomes the face value of the letter of credit. The cost of the order becomes the amount of an escrow. So the plaintiffs then know that the funds are there to assure completion of the order. It's just not a paper victory, but things will happen. If they don't, then the money is available to make them happen.

Q. And did you say that a letter of credit will survive bankruptcy?

A. Yes. They are typically written with a clause in them that says the letter will be honored in the event of a bank bankruptcy and/or the event of an insolvency proceeding, and they are not affected by the automatic stay. So you get the bank to agree to pay to the beneficiary of the letter of credit, which in this case I would imagine would be the Court, the sum, regardless of whether the company, Patriot, is in financial distress. So the bank is taking on that obligation to go get the money from Patriot.

The bank provides the funds to carry out the order. The bank then has to go back to Patriot and secure its collateral or secure its loan from Patriot. So the plaintiffs are out of this, out of that transaction.

Q. And if I understand what you're saying, there are advantages to a letter of credit to both defendants and plaintiffs in that case.

A. Oh, yes, yes. The advantage to the defendant is, is that it doesn't have to put up the whole amount in escrow. It has to only put up a small fee to have a letter of credit. And the plaintiffs, they have the advantage of having it escrowed with the letter of credit because it's negotiable, because it's a negotiable instrument, not that -- it's easily turned into cash, easily turned. And then that cash can be used to do the plan and the grading and buying the equipment and operate it.

Q. Do letters of credit have a face value?

A. Yes, it does.

Q. And if someone were to go and try to cash or negotiate, I guess would be the correct term, the instrument, do they have to get the full face value?

A. They don't have to. They may take partial draws. That is often another part of the letter of credit, that partial draws are allowed.

Q. And so in this case if, say, half the facility were constructed, the second half remained, the letter of credit, even though on its face would be for the full amount, you could draw only the remainder that's necessary to complete the project?

A. Absolutely, yes.

Q. Okay. Pardon me. Do you have an opinion as to what the appropriate method for a financial assurance in this case

might be?
A. Well, I'm very much in favor of letters of credit. I think that starting out with an escrow account might be the best way to go to hasten the securing of the letters of credit. That would be my -- my opinion is that you should establish an escrow account immediately upon the order and then release the money from escrow as letters of credit are obtained.

If you add, talking numbers here, $100 million worth of work that seems to be required by the order, so you'd have to escrow $100 million. Then as you got a first letter of credit for 25 million, you could release $25 million. And a second letter of credit with another bank comes in for $50 million, you can release another $50 million. And when the third letter of credit comes in for the remaining 25, then you release that from escrow.

And so now in this example, you have three letters of credit that in combination cover the cost of the order and will remain in effect until the project is done.

Q. Do you have an opinion about whether or not a financial assurance of some kind is necessary in this case?
A. From what I've read, yes. I think there should be financial assurances in this. It's a contempt proceeding, and that means to me that the first --

MR. GARDNER: Your Honor, I'm going to object to

this because I think the witness, who has been qualified as an expert in economic matters, is now testifying about legal conclusions.

THE COURT: Well, overruled.

MR. TEANEY: Thank you, Your Honor.

THE WITNESS: I think your first instrument of a written consent decree didn't work. And I don't think that another -- I think you need something stronger, because the first one didn't work. And the next thing to me would be financial assurances. And when I get to financial assurances, the most immediate is an escrow, and I think a more durable and less expensive way to go are letters of credit.

BY MR. TEANEY:

Q. Thank you. I just have one final question. Is there anything else about letters of credit or financial assurances that you think we need to understand?

A. No, I don't think so. I don't think so.

Q. Okay. Thank you. I have one final topic to address, and I have an exhibit I would like to use for that.

May I approach, Your Honor?

THE COURT: You may.

MR. TEANEY: A copy for the Court. I would actually like to use this exhibit in tandem with Plaintiff's Exhibit 60. May I approach the witness to provide him a copy?

THE COURT: Yes, you may.

MR. TEANEY: Thank you.

BY MR. TEANEY:

Q. Dr. Kavanaugh, do you recognize the spreadsheet that has been marked as Plaintiff's Exhibit 69?

A. Yes, I do.

Q. Did you prepare this spreadsheet?

A. I prepared part of the spreadsheet and checked the part that I did not prepare against the Potesta July 2009 document.

Q. What do these numbers in this spreadsheet indicate? Where are they from?

A. They are from the Potesta document dated July 2009, and they are from Bates pages ending 057 to 065. The Potesta document that we received was difficult to read in the form in which we received it, and so the spreadsheet was created from the hard-to-read document.

Q. And you have verified that these numbers are --

A. They were transposed correctly.

Q. Okay. And what is your understanding of what these numbers represent?

A. They represent spending at Apogee Outfalls 1, 2, and 3 through time and projected spending at Apogee Outfalls 1, 2, and 3, the environmental selenium compliance spending at Apogee Outfalls 1, 2, and 3.

Q. Looking at the Potesta document and this spreadsheet, were you able to draw a conclusion as to what amount of money

Apogee or Patriot projected to spend on Outfalls 1, 2, and 3 for installed capital?

A. Yes. The outfall installations were listed in columns for each outfall against each date, and at Apogee Potesta made an estimate of what the total capital plus operating costs would be and what total installed capital would be. And Potesta estimated that it would be about $1.3 million for all three outfalls.

Q. So they estimated that they were going to spend $1.3 million for total installed capital --

A. Yes.

Q. -- for those three outfalls?

A. Yes.

Q. Do you know what time period those dollars --

A. Yes. Yes. They were spent over a time period August the 8th to -- excuse me -- was spent over a time period of August 2008 until the year 2038. Most of the capital, however, would have been spent between September 2008 and the second quarter of 2010.

Q. And what years -- I don't know if I'm asking this question correctly because I'm not good at economics or finance, but what year's dollars are these numbers in?

A. Well, they're in a variety of year dollars.

Q. Okay.

A. A better way to express the total installed capital would

be to convert these dollars all to a common denominator and then express it as in terms of that common denominator. They didn't do that, and -- but because the time between September 8 and 2010 is shored, the failure to do that for installed capital doesn't make a big difference. And to demonstrate that, I went and made a calculation that put them all in a common denominator so that comparisons would be more apples to apples instead of apples to -- instead of fruit, more apples to apples.

Q. What was the common denominator that you worked these numbers out to?

A. I did it in terms of July 2009.

Q. And why did you select that date?

A. Well, that was really, if I remember right, the date of the Potesta report.

Q. And the 1. -- roughly 1.3 or just shy of 1.3 is in 2009 dollars?

A. Yes. So it's not a big difference between what they were doing, and so that shouldn't be -- my interpretation of the document would be that for installed capital and rounding up a little, 1.3 million is a good present value common dollar estimate of the installed capital that Potesta made for the three outfalls at Apogee.

Q. And have you converted that to 2010 dollars?

A. I don't have that. I think I have made that calculation,

but I don't --

Q. Let me direct you to page 3 of the --

A. I have just found it. I have it's a little over $1.3 million; 1.33. It is on the last page of the exhibit.

Q. And to confirm, that's the 2010 dollar value for the total installed capital at Apogee?

A. Yes.

Q. Based on the Potesta document?

A. Yes.

MR. TEANEY: Thank you. If I could have just a moment to confer with co-counsel.

At this time plaintiffs would move for the admission of the exhibits we've used, which I believe included the resume, the copies of the model, and then the last spreadsheet we were just discussing.

THE COURT: All right. Any objection?

MR. GARDNER: No objection, Your Honor.

THE COURT: They're admitted.

MR. TEANEY: Thank you, Your Honor. No further questions.

THE COURT: Before you conclude, I'm curious.

MR. TEANEY: Okay.

THE COURT: I don't quite understand what's in the far right columns here.

THE WITNESS: Those are my calculations. I made

some calculations based on -- after we constructed this spreadsheet, I just went up into the right-hand corner and just made some calculations based on what I saw and to put them in a common denominator.

THE COURT: Well, what are these calculations?

THE WITNESS: Oh, they are my calculations of the present value in July '09 dollars of the total installed capital at Apogee.

THE COURT: All right. Okay.

BY MR. TEANEY:

Q. And just to make sure I understand, we've got here in the right 209,533; 235,450; and then 813,410. Is that 813,410 the sum of --

A. Yes, it is.

Q. -- what Potesta had as Outfalls 2 and 3?

A. Yes, Outfalls 2 and 3 in the first half of 2010.

Q. Okay. So that's where the eight thirteen came from.

A. Yes.

MR. TEANEY: Okay. Thank you. No further questions.

THE COURT: All right. Mr. Gardner?

CROSS EXAMINATION

BY MR. GARDNER:

Q. Dr. Kavanaugh, good morning.

A. Good morning.

Q. My name is Blair Gardner. We've spoken before on the telephone at your deposition.
A. Yes. Thank you for staying late and accommodating the time difference for me.
Q. Well, actually, sir, I think it was more the latter. I think you were accommodating us because you were up quite early for that, but welcome to West Virginia.
Your testimony by and large has been, I think, clear and consistent between today and your deposition. I would like to ask a few clarifying questions starting with the -- you've referenced a Duff & Phelps report that you said you have reviewed and which has previously been offered into evidence in this court.
I believe you testified that you took your weighted average cost of capital from that Duff & Phelps report.
A. Yes, sir.
Q. Which you say you've estimated at 13 percent.
A. Yes.
Q. You found that Duff & Phelps calculation credible, and you've used it for preparing your opinions in this case; is that correct?
A. Yes.
Q. Moving on to the model that you have described today, I think you're clear, and I understand it today as I understood it at the time of your deposition, the various components of

the model assuming expenditures over quarters, however those quarters end up being estimated or calculated, whether it's two years or three years or something in between, different percentages that are expended in each of those quarters, and then using the capital that must be expended for the entire project, estimating fluctuations in the expenditure of capital over time.

Here's my question, though. Let's start with the concept of delay. Now, in your model and your explanation this morning, in your direct examination, you use the example of the responsible officials of the company going to Florida or Hawaii, if you prefer, sir, for the period of time and thus doing nothing, expending no effort, and you calculate your penalty.

I'm going to ask a hypothetical, and help me work through this as to how it would work in your model. Let's assume that the company at whatever relevant point in the project is prepared to move, it's got the capital allocated, it's got the personnel prepared to do the work, wants to spend the capital, is willing to spend the capital, but there is an approval that must be given by a relevant government agency. The documents are before the agency, all of the information that the company can supply is there, and the agency isn't making a decision. There's a delay and the company cannot do what it needs to do in the absence of a decision. How does that get factored into

your model?
A. That would be factored in by the credit for effort, that the -- I think that the institution that's responsible for levying the fine would have to make a determination about how much credit for effort. If you've done all you could and it's beyond your control and I was advising that person, I might very well say that they fulfilled everything that they had to do and give -- if the only impediment is something that's beyond their control, that seems to me to be satisfactory effort.

To give you an example, I was working on a project in New Orleans involving the sewer system, and we hammered out a consent decree that set out schedules and what they had to do, and Hurricane Katrina came through. Well, that whole schedule, that's all gone away. These things happen.

So in your example, I would use the flexibility of the model that says that if it was agreed upon that it was beyond your control, that would give you credit for that, for that effort.

Q. Dr. Kavanaugh, in your testimony this morning, do you believe that that credit for effort is implicit or might it need some additional description or fleshing out if something like this were adopted?

A. Well, I think that a process around it that you could make an argument about how much credit you should receive and

that the plaintiff might make an argument about how much credit you should receive and someone would have to determine it. You may be able to come to that conclusion among yourselves. That would be, I would think, preferable, but ultimately I think the -- it should be structured so that someone can make a final determination.

Q. So there's nothing in your model that prohibits, for example, the parties agreeing or the Court requiring that periodically the parties have an opportunity to come back to the Court or to someone that the Court might appoint to basically be an umpire --

A. Yes.

Q. -- to resolve --

A. A special master, if you will, yes.

Q. Another question about the model. It assumes -- and I think I understand for purposes of economic models that certain assumptions have to be employed in order to construct the model. But it does assume that at the outset of the model, that, in fact, the costs of the project are known; is that correct?

A. You have some idea, yes. Dr. Koon was testifying yesterday there are these uncertainties and there are some risks involved. We have estimates of what's required. I could see the model being recalibrated as that new information comes in to being.

Q. Well, that was my question. That was what I was moving toward. You testified, I believe, that you have read various reports prepared by CH2M Hill; is that correct?
A. I have read some of those.
Q. Did you notice in the reports that those estimates of the cost that they provided were what they described as a Class 5 estimate?
A. I noticed that.
Q. And do you recall what the range was and what they called a Class 5 estimate?
A. I did. I don't recall it at this moment, but it was what I thought a fairly wide range.
Q. So if something were ordered by the Court based on that estimate, would your model -- could your model accommodate a refinement of that so, for example, once an engineering plan was done and a more precise cost estimated, that the penalty calculation that you have provided here likewise could be recalibrated?
A. Yes.
Q. Let me go to another feature of your model, and it was one that you touched on just briefly today but we discussed a bit more at length I think in your deposition, and that's what you call the margin of safety.
A. Yes.
Q. Can you explain again what that is intended to do?

A. That the model -- in the construction of a model up to that point, I have been looking for a point of indifference between paying the fine and executing the plan. I don't want indifference. I want to tip the scale in favor of compliance with the order and not using the fine as a cost of business. So that margin, that extra 10 percent is an attempt by me to tip the scale in favor of compliance and away from pay the fine and move on.

Q. And you chose 10 percent, didn't you, sir?

A. Yes, I did.

Q. And that was an arbitrary number that you applied.

A. Yes, it was. I would think that if it wasn't working, you could increase it.

Q. Likewise, if the company came forward with something very quickly, it could be decreased as well, could it not?

A. I -- well, you would be getting credit for effort, so it wouldn't be if -- the margin for safety kicks in and is really binding only when there has been a shortfall in the execution of the order. So I would be more reluctant to reduce it than I would be to increase it.

Q. Nevertheless, sir, it was an arbitrary number that you --

A. Yes, it was.

Q. Let's move now to this other aspect of what you -- well, first of all, let me be clear, and I think you were, but I just want to confirm it one more time. This model is intended

to be -- to act in a purely prospective way; is that correct?
A. That's correct.
Q. You're not testifying today about any economic benefit that anyone could assume has been received by Patriot Coal; is that right?
A. That's correct.
Q. In fact, in your deposition do I recall you saying that you were not going to offer any opinion about that, about any economic benefit?
A. Right, as economic benefit is understood as being a component of a civil penalty policy.
Q. Understood. Let's move on to the questions about financial assurance. You've expressed a favor for what you call a financial assurance mechanism that you've described as possibly being an escrow account or a letter of credit. You prefer the letter of credit I think because you think it's somewhat easy to administer, you believe it has a cost that is less than just a full escrow account and because it survives bankruptcy. Is that a fair summary?
A. Yes, it is.
Q. Were you here in the courtroom this morning when Mr. Schroeder testified?
A. Yes.
Q. You certainly understand the concept of liquidity, don't you?

A. Yes, I do.
Q. Do you understand, I mean at this time, based on the information that you've read about Patriot and its financial disclosures and the testimony you've heard, what the cost of a letter of credit would be to the company?
A. I don't have any quote. My understanding is that the cost of a letter of credit is negotiated between the issuer, the bank, and in this case Patriot, that they would come to an agreement about what that is. My understanding and experience has been that it's 1 percent or less of the face value.
Q. Do you have any understanding, though, of how the imposition of a letter of credit, especially in the full amount of the total installed capital cost for a project, whatever that might be, would have on the company's liquidity?
A. Well, Mr. Schroeder was describing some covenants. I am not familiar with those covenants, so I can't speak to that. I would say that a letter of credit would leave the company more liquid relative to the position that an escrow account would leave the company.
Q. I understand, but, for example, if the total installed capital cost for the project were $1 million -- and to use your hypothetical, the cost of that was merely 1 percent -- that would be --
A. A hundred.
Q. -- a hundred dollars. If, in fact, there's an effect on

liquidity and the impossibility, then, of the company to use that liquidity for other costs that occur in its business, that's going to be more than $100, isn't it, Dr. Kavanaugh?

A. Well, any -- maybe I should -- I think the arithmetic would bear you out on that. Any financial assurance will have an effect on liquidity. It's not possible to give a financial assurance to a third party and not have your liquidity affected.

It seems to me that the liquidity is not the best measure, because you want to know -- you had an opportunity -- you want to know -- you're giving the order a higher priority in this situation. You want the fulfillment of the order to have a higher priority than the maintenance of a particular level of liquidity. To make sure that the order occurs, you need financial assurances. Necessarily that means liquidity will go down.

I will -- you know, I will agree with you on that. I think further, though, that of the assurance instruments, the one that will affect liquidity the least will be the letter of credit.

Q. Do you think a letter of credit would affect liquidity more or less than a surety bond?

A. I don't think a surety bond is an effective financial assurance.

Q. Well, that isn't really what I asked. Would a letter of

credit affect liquidity more or less than a surety bond?
A. A surety bond would affect liquidity less than a letter of credit --
Q. All right. Let --
A. -- unless its premium were much higher than what I would anticipate it to be.
Q. So your estimation, then, is really based upon your experience and judgment about a letter of credit, but you really don't know in this particular instance how posting a letter of credit in an amount equal to the total capital installed cost might affect the company's liquidity.
A. Well, I don't think anyone knows that in advance. I saw your chief financial officer basically testify the calculations -- the chain calculations that he would have to go through I think were at a stage of just doing ranking rather than being able to be precise about the change in liquidity.
Q. Finally, have you ever heard of instruments called liquidity letters, in other words, a report by a company to another party about the changes in liquidity on some periodic basis?
A. I'm not familiar with that.
Q. Basically what you're looking for in a financial assurance mechanism, are you not, is simply some verification that the company will proceed with the project that the

parties or the Court might impose? Is that correct?
A. No, what I'm looking for in financial assurance is the purchasing power to carry out the order if the company isn't carrying out the order. So I don't -- I want a negotiable instrument. I want to be able to go to a bank and get funds to purchase tanks and electricity and labor and materials to carry out the order.
Q. But in the example that you gave -- and perhaps I didn't understand it as I was listening to your testimony. If the company were to provide the financial assurance mechanism that you seek, in addition to having to expend the funds over whatever period is eventually ordered by the Court, is the company -- if the company posts a letter of credit or other mechanism at the inception of the project, as the capital is being expended is there not more financial assurance as the project proceeds than is needed to complete the project?
A. Yes. And you could then adjust the letters of credit. If you had more than one letter of credit, then -- let's say -- I believe the example I had was where you had three letters of credit totaling a hundred million dollars, one for fifty and two for twenty-five. And as the project proceeded, you might not need one of those letters and you could cancel that letter of credit and just have seventy-five. And as the project proceeded, you could cancel a second letter of credit and just have fifty. And as the project proceeded, you could

replace the $50 million letter of credit with a $25 million letter of credit.

You just need to have a letter of credit in place that will pay for the resources that are needed to complete the project.

Q. And assuming the project is ongoing on whatever agreed schedule, that should diminish over time.

A. Yes.

Q. Okay. And, again, sir, in proposing what you have today, it has been purely for that objective and not to impose any sort of economic penalty on the company; is that correct?

A. That's correct.

Q. All right. One -- I think one final question. In the previous cases that you discussed with Mr. Teaney in your previous expert testimony, you described a case, *Friends of the Earth v. Laidlaw*.

A. Yes.

Q. And it began in the District Court of South Carolina and then proceeded through the Fourth Circuit. Did you present an economic benefit calculation in that case?

A. Yes, I did.

Q. Was that subsequently upheld?

A. Yes.

MR. GARDNER: Thank you.

THE COURT: All right. Any redirect?

MR. TEANEY: Briefly, Your Honor, and I think I can finish it pretty quickly.

THE COURT: Hold on just a minute. My court reporter needs to change paper.

MR. TEANEY: Certainly.

REDIRECT EXAMINATION

BY MR. TEANEY:

Q. Dr. Kavanaugh, Mr. Gardner used a hypothetical with you where a permitting authority delay interrupted the schedule. Based on that hypothetical couldn't you also, as one way to deal with that unforeseen delay from an external source, extend the time period rather than purging the fine?

A. That would -- that would be -- that would have consequences throughout, but, yes, you would -- you would -- you could do that. Instead of -- instead of having a project -- all right. Let me try it this way.

Instead of having a project that was to last 900 days, if there was an unforeseen permitting problem that cost you 100 days, you could recalibrate the model for a 1000-day project and spread it out that way, or maybe it cost you more. I mean you would have to come to some conclusion about the length of the time that that permitting delay caused. If you could do that, then you could extend the project.

The other alternative was the answer I gave to Mr. Gardner, which was then you could adjust the amount of

credit you gave for their effort, but that is another variable that you could touch, which would be the length of time for the whole project.

Q. Could you adjust that length of time such that its effect was only on that particular quarter?

A. No, I don't think that -- I don't know. I don't think so, because there's this linkage among quarters.

Q. Uh-huh.

A. So I think you would have to go in -- you're coming up against a rigidity in the model. I, in constructing and designing, did not take into account variable length milestones. There's always a set time and an amount of money that is spent between each of those quarters, and now you're asking for a flexibility that I did not consider. This is not the time to do that.

Q. Right.

A. And it may be possible to make that modification, but I can't -- I can't answer that question from here right now.

Q. Fair enough. At the outset what level of confidence do you need in the cost to plug the cost in at the outset of the order?

A. I don't know that that is -- I mean I don't know what that is.

Q. Could you reevaluate the cost at each quarter --

A. You could.

Q. -- as the cost is known at that time?
A. Yes.
Q. Okay. With regard to the margin of safety, that 10 percent, I believe the word arbitrary was used to describe it, but in reality that 10 percent does have a relationship with the weighted average cost of capital, doesn't it?
A. Yes, it does. You could take that and increase the weighted average cost of capital to reflect -- that would be another way to build the margin of safety into the model. I did not go in that because I wanted to show that the opportunity cost that I was using was -- I wanted to show its pedigree. I wanted to show where it came from and how it was and all that. I didn't want to then go in and start adjusting it. So I kept that adjustment separate so that it was transparent.
Q. So it's not entirely arbitrary, then. It's for the sake of transparency. It could --
A. Well, I -- yes, I brought it out to make it transparent. Whether the amount is 10 percent, 20 percent, 30 percent, that was not a number that I came to after a deliberate consideration of facts or literature. It was 10 percent.
Q. In your opinion would any margin of safety less than 10 percent have this sufficient coercive effect?
A. I don't think so, because I did run one experiment where I said what if -- if I would have taken the alternative method

and built in and made the margin of safety less transparent by burying it in the opportunity cost, what would that opportunity cost rate have been? And for the model runs that I did, it brought about an increase in the opportunity cost from 13 to 14 percent. So 10 percent made a small change in the opportunity cost.

Q. Do I recall that 14 percent also turns out to be the equity cost of capital?

A. You are correct.

Q. With regard to financial assurance, Mr. Gardner asked you about surety bonds, and I think you started to express an opinion that a surety bond wouldn't work here.

In your opinion what are the problems that a surety bond would pose in this situation?

A. Well, a surety bond brings another party in to argue about the type of controls and how the order should be fulfilled, and it is not very protective of the plaintiff. You've basically substituted an insurance adjustor's opinion about what should occur for the Court's opinion about what should occur. And surety bonds often aren't written over long periods of time, but you might not need a long period of time here. And a surety bond is only going to be as good as the insurance company that writes it, and I did an investigation about 18 months ago and was very surprised about the number of insurance failures.

I'm uncomfortable with surety bonds for those reasons; one, that you need a strong insurance company to write it, and two, you have an opportunity for an insurance company to dispute your conclusion that the order isn't being fulfilled.

Q. Could the use of a surety bond then result in a collateral attack on the order that the Court had issued from the prospective insurance company?

A. Yes.

Q. So we could end up relitigating this again?

A. I -- yes. I don't like to ponder that, but yes.

MR. TEANEY: Neither do I. Thank you. No further questions.

THE COURT: All right. Recross?

RECROSS EXAMINATION

BY MR. GARDNER:

Q. Dr. Kavanaugh, just very briefly. Permitting delays. You've worked with a lot of government agencies over your career, haven't you?

A. I have had them as clients, yes.

Q. Have you experienced delays in agencies making decisions in various projects that you've been involved in?

A. I have seen that occur.

Q. Thank you. Surety bonds. Do you agree that many construction projects use performance bonds in the -- to guarantee performance of various aspects of construction

projects?
A. Yes.
Q. Are you -- do you agree that the U. S. Treasury Department maintains a list of qualified sureties that the federal government and its various agencies can turn to for issuance of surety bonds?
A. Yes.
Q. So it's not an unknown use to guarantee performance; is that correct?
A. That's correct.
Q. All right. I think just one final question. If the issue of a letter of -- or the issuance of a letter of credit as you have hypothesized in your testimony were actually to make more difficult the actual construction and commissioning of a project for purposes of achieving compliance, would you agree that that actually then is increasing the cost for the success of that project beyond which you've testified to today?
MR. TEANEY: I'm going to object. This is beyond the scope of the redirect.
THE COURT: Overruled.
THE WITNESS: Financial assurances or any financial assurance, from escrow, through letter of credit, to surety bond, is going to increase the cost of the project.
BY MR. GARDNER:

Q. But you don't --
A. But in return, you get the assurance that the project will be completed. You get -- I'm sorry.
Q. But you don't want a mechanism that actually imperils the execution of the project, do you?
A. Well, do I want a mechanism -- no, I want a mechanism that assures the completion. No, I don't want a mechanism that imperils it. I want --
Q. That's all I have. Thank you very much.
A. -- a mechanism that assures the completion of the project.

THE COURT: All right. Any further questions?

MR. TEANEY: No, Your Honor.

THE COURT: If not, Doctor, you're excused. Thank you very much.

THE WITNESS: Thank you.

THE COURT: All right. Does the plaintiff rest at this point?

MR. TEANEY: I expect that we do. I am looking around for my co-counsel, and I don't know where he is. So he may tell me differently, but I believe we rest.

THE COURT: Well, we're going to go ahead and take our recess now. We're going to recess until 1:30. I suggest that the defendants have their witnesses ready. I presume this ends the plaintiff's case and we'll be ready to start

with the others.

MR. MCLUSKY: Yes, Your Honor.

THE COURT: We'll stand in recess until 1:30.

(Lunch recess from at 12:10 p.m. to 1:35 p.m.)

AFTERNOON SESSION

THE COURT: All right. Are we ready to proceed?

MR. HURNEY: Your Honor, if I might, before I start, as a scheduling matter, I've got two witnesses to put on this afternoon. I had not told my other witness to come and instead had planned for first thing in the morning. What I fear is I may run short on the Court this afternoon. I wanted to get some guidance on that.

THE COURT: Well, I guess my only question is if you don't have other witnesses until tomorrow, when do you expect to finish your case?

MR. HURNEY: I will finish my case tomorrow.

THE COURT: Then that's fine.

All right. I assume, then, plaintiffs do rest.

MR. LOVETT: Yes, Your Honor.

THE COURT: All right. Go ahead, Mr. Hurney.

MR. HURNEY: I'd forgotten that part, Your Honor.

THE COURT: Well, they weren't quite sure when we went to lunch.

MR. LOVETT: I'm sorry, Your Honor. I snuck out early. I apologize.

MR. HURNEY: Your Honor, at this time we call Timothy Harrison.

THE COURT: All right. Mr. Harrison, if you'll step right up here, my clerk will swear you in.

TIMOTHY HARRISON, DEFENDANT'S WITNESS, SWORN

MR. HURNEY: Your Honor, may I approach?

THE COURT: Yes, you may.

DIRECT EXAMINATION

BY MR. HURNEY:

Q. Would you state your name for the record, please.

A. Timothy Harrison.

Q. Where do you work?

A. I work for CH2M Hill in Cincinnati, Ohio.

Q. Okay. And what is your position with CH2M Hill?

A. I'm a senior project manager.

Q. What is a senior projector manager?

A. I'm the firm's lead for running projects that we deliver for clients. I have responsibility for things like budgets, schedules, deliverables, quality, those kinds of things.

Q. In general, what type of projects do you run?

A. Environmental projects. My main area of focus is industrial wastewater, but I manage other types of environmental projects as well.

Q. I'd like to hand you Defendant's Exhibit Number 4. Could you look at that document for me, please.

A. Yes.
Q. What is that?
A. That's my resume.
Q. All right. Is it current or reasonably current?
A. Reasonably current.
Q. Okay. Do you have a longer version of this?
A. I do.
Q. So this is the *Readers Digest* version of the Tim Harrison resume?
A. Yes.
Q. All right, sir. Would you tell me, just looking at this, where did you get your undergraduate degree and in what subject?
A. Undergraduate was a BS in biology from George Mason University.
Q. And when did you graduate from George Mason?
A. 1987.
Q. What did you do next?
A. I worked residential construction for a couple of years.
Q. Were you running the job or working?
A. I was a piecework drywall finisher. I started actually to work my way through undergraduate doing that and just continued on for a couple of years after I graduated.
Q. That's a good skill to have. Did you proceed to graduate school?

A. Yes, I did.
Q. And where did you go and what degree did you obtain?
A. I went to Virginia Tech and obtained a master of science in environmental engineering.
Q. Do you have any licenses or certifications?
A. I have an Ohio professional engineer license.
Q. And what does that mean?
A. That means I'm certified to stamp drawings and so forth in the State of Ohio.
Q. Okay. I take it that after you graduated from your masters degree, you went to work. Tell us where you went to work.
A. CH2M Hill.
Q. Okay. And where were you first employed by CH2M Hill?
A. Milwaukee, Wisconsin.
Q. Let me ask you this question. What is CH2M Hill and explain the name.
A. Okay. CH2M Hill is a large design, procurement, engineering consulting firm. We have about 25,000 employees around the world. And I'm sorry, what was the second part of your question?
Q. I'm just curious about the name, CH2M Hill.
A. Oh, the name. Yeah, the name was the -- the CH2M is the initials of the four founders of the company. It was a professor and three students from Oregon State University that

after World War II, they came back and opened up a little engineering firm on top of a hardware store. And then in the '70s they merged with the Clair A. Hill Company, and I guess he didn't want the H added to the CH3, so he had his name stuck on the end.

Q. You got your masters degree in environmental engineering. What is environmental engineering?

A. In my view, it's the use of math and science to solve environmental problems.

Q. All right. So you go to CH2M Hill in Milwaukee. What kind of stuff did you do?

A. I started out just as a project engineer. I worked on a range of projects. In that area we had a lot of pulp and paper client work. So work involved in design and start-up related to pulp and paper plants is one of the main areas that I dealt with.

Q. What types of systems were you designing?

A. In that particular case, they were large wastewater treatment systems. We did one for Tenneco Packaging that was a 25-million-gallon-a-day aerobic and anaerobic treatment system.

THE REPORTER: I'm sorry. I didn't understand you.

THE WITNESS: I'm sorry. Aerobic and anaerobic treatment system.

BY MR. HURNEY:

Q. How long were you in Milwaukee?
A. Four years.
Q. And where did you go to from Milwaukee?
A. I transferred to our -- excuse me -- Cincinnati office.
Q. How long have you been in Cincinnati?
A. For 14 years.
Q. Could you describe for the Court kind of over the past 14 years what your responsibilities with the company have been and how they have either -- you know, promotions or changes?
A. Yes. With CH2M Hill we have kind of three primary career paths, whether you go into kind of a project management career path, a technologist career path, or more of a sales/business development type career path.

I followed the course of a project manager career path, so I stayed involved in the technical aspects of engineering projects but kind of grew from task manager to project manager to senior project manager.
Q. And you're currently a senior project manager?
A. Yes, I am.
Q. Would you describe for the Court what a senior project manager does at CH2M Hill.
A. Yes. I'm responsible for the successful delivery of our scope of work that we receive from our clients, responsible for schedules, budgets, client satisfaction, quality of our deliverables, coordinating and getting the right resources on

the team. Those are some of the key things I can think of.
Q. Are you involved in terms of the planning and scheduling of projects?
A. Yes. So I'm also involved in the writing of proposals, the scopes of work, that kind of thing.
Q. Do you have experience as a project manager in dealing with, you know, projects like this one where you're asked by a company for assistance in solving a wastewater problem?
A. Yes.
Q. And for how many years have you been managing these types of projects?
A. Probably 12 years.
Q. Okay. Do you belong to any organizations in your field?
A. Not currently.
Q. Okay. Do you attend continuing education or seminars or meetings of like folks in your field?
A. I do. One of the requirements of the Ohio professional engineering license requires that you maintain 15 hours a year of credit in taking courses and being involved in seminars and so forth.
Q. What type of educational things do you attend?
A. It's a wide variety. One of the nice things about CH2M Hill is that it's such a large company with so many areas of expertise that a lot of our internal training qualifies for that certification.

MR. HURNEY: Your Honor, at this time I'd ask the Court's leave to treat Mr. Harrison as an expert witness as it relates to the field of environmental engineering and the management of environmental projects.

THE COURT: You may proceed.

BY MR. HURNEY:

Q. Mr. Harrison, are you familiar with Apogee Coal Company?

A. Yes.

Q. All right. Have you been working on a project or a series of projects to assist Apogee Coal Company with the removal of selenium from outflows at the Apogee Mine --

A. Yes.

Q. -- or the Ruffner Mine, rather? All right. When was -- do you know when CH2M Hill was first contacted?

A. Yes. Mid July 2008 we received a call from John McHale and asked for our kind of experience and expertise around wastewater treatment and selenium specifically.

Q. Okay. Did somebody at CH2M Hill get in contact with Mr. McHale?

A. Yes.

Q. And who was that?

A. My recollection, it was Tom Sandy.

Q. After Mr. Sandy talked with Mr. McHale, did you become involved in the project?

A. Yes. As soon as we identified that they had a scope of

work that they wanted us to deliver, I got engaged immediately on the proposal development and the delivery of the scope of work.

Q. Okay. Would you tell the Court what you mean when you say scope of work.

A. I'm sorry. It's basically a definition of what we're going to do for the client, and it outlines things such as schedules, budgets, activities, things that we need from them, information requests, so that both parties have a clear understanding of kind of what the objective of the project is and what needs to be done.

Q. What was -- I'm going to place a series -- can I just put this stack in front of him, Judge?

THE COURT: Yes, you may.

MR. HURNEY: I think it might be more efficient. I hope it's more efficient.

BY MR. HURNEY:

Q. You exchanged some documents -- I believe you exchanged some reports with or had some communication with John McHale. What was the first project that you were asked to do?

A. The first project we were asked to do was a small, ten- to fifteen-thousand-dollar evaluation that included -- one was kind of a high-level screening of technologies that have been shown effective in treating selenium.

Q. Okay.

A. Another task was -- kind of basically asked us how we would approach a project, understand the issue and approach it to resolve it. It was kind of a skeleton outline of what we would propose as the scope of -- the next scope of work.
Q. Okay. Let me ask you to look at Exhibit 3 in front of you. What is that document?
A. This is one of our later deliverables. After that initial scope of work, we had a follow-on scope of work which really had a list of four or five tasks, one of which this deliverable addresses. Specifically it was to do a screening-level regulatory evaluation to understand selenium permit limits, the basis of those and if there were regulatory options to address that through a change of a discharge criteria.
Q. I need to go get one more document. I'm trying to find your document from November. Do you have a recollection of what kind of information you transmitted to John McHale in November of that year?
A. Let me see.
Q. Now, you have a document in front of you. Using your scheduling tool did you prepare kind of a timeline of things you did to assist you in remembering dates?
A. Yes. Since the project has been over two years, I wanted to refresh my memory on when we did what.
Q. Would a reference to that document assist you in

recalling specific dates that you did things?
A. Yes, that would help.
Q. Now, so talk to me about November, about the initial communication back to Patriot and the kind of things that you were discussing with them.
A. And just -- are you talking about a first deliverable in the Summer of 2008?
Q. Sure.
A. Okay.
Q. What I really want to try to do, and I apologize. I thought I had all my documents in line, and I do not. What I really want to do is walk through with you -- and I've kind of drawn a timeline when I was taking Mr. McHale's testimony, and I really want to get a sense from you of a timeline of what CH2M Hill did for Patriot Coal and when they did it.
A. Sure.
Q. So if you could just start after you were hired, what was the first thing that you did for Patriot Coal?
A. Okay. We first met with them in July. Our first real work activity started in August of 2008. That first small scope of work, we did a screening of selenium technologies, which was just a table to understand what technologies are appropriate.
Q. Do you have that in front of you? Is that one of those documents --

A. Let me see.
Q. -- an initial screening? I'm having trouble putting my hands on it.
A. It would have been a small document --
Q. Okay.
A. -- a few pages. I don't see it here.
Q. Well, why don't you -- let's just discuss it. I don't know that it's all that important to have the document, but what was the -- what was the -- tell me, what was in that document?
A. Three things; basically a site visit for me to go meet with John McHale, and we did a one- or two-day site visit at both Apogee and the Hobet mine sites. The second item was basically a table of technologies that are typically used to treat selenium, the pros and cons, that was kind of a high-level these are the things that seem reasonable to address selenium, end of pipe treatment. And then the final thing was literally a skeleton outline of if we were to take the next step, let's try to better understand this issue. How would we proceed down the path in a logical, systematic way?
Q. Okay. And ultimately what were the recommendations that you made at that time for the things that you thought you needed to do to proceed down the path?
A. Okay. There was -- the first item kind of refers to this regulatory screening that was one of the outcomes, that we

perform a high-level regulatory screening around selenium.
Q. All right. And that was October 21st of 2008?
A. November 21st.
Q. November?
A. Yes.
Q. All right. And did you submit a technical memorandum on that date?
A. I -- let me look at my cheat-sheet here.
Q. Let me ask you to look at Exhibit 3 --
A. Okay.
Q. -- in the stack in front of you.
A. Yes.
Q. Okay. Is that a technical memorandum?
A. Yes, it is.
Q. Is that the memorandum to which you're referring?
A. Yes.
Q. All right. So that was the first thing. What else did you supply to Patriot Coal as a recommendation for further analysis?
A. One of the next main items was there was very little data or at least data that we felt was of good quality to understand the selenium at these outfalls. And what I mean by that is there was no data that speciated the selenium, which is one of the really important things to understand, the form it's in from both a toxicity perspective and a treatment

technology perspective. So when we got on-site there for the first time, the historical data was just total selenium.

The second aspect of that -- so, really, we really wanted to characterize both the water quality and the flows. So there were kind of two parallel paths. One was a watershed evaluation study we did and, in parallel to that, field work where we actually spent time on-site collecting samples over a period of a week at each of these outfalls to look at not only selenium but other chemical parameters that you need to understand to design wastewater treatment systems.

Q. Did this result in the reports that you all submitted on January 26th of 2009?

A. Yes, it did.

Q. Okay. And what reports did you submit that -- did you ultimately submit to Patriot in January of 2009?

A. Yeah, there was three reports that we submitted. The primary -- well, the first was the -- what we call the design basis. And to step back a little bit, once we had a -- we really needed both flow and chemical character information in order to do a conceptual evaluation. So that was one of the recommendations of our original scope of work.

So we did a storm water evaluation. That deliverable was one of those January reports --

Q. Okay.

A. -- or watershed evaluation --

Q. Let me interrupt you. Would that be Exhibit 4, the preliminary watershed flow estimation?
A. Yes.
Q. Okay. Do you have Exhibit 4 in front of you?
A. Yes.
Q. Okay. And that's the -- so that's the report. And tell the -- what I want to -- I'm going to focus on you on kind of generally what was done and when it was done, and Mr. Sandy will be testifying later. I may go into more details on the technology, but just in general, would you explain to the Court what Exhibit Number 4 is?
A. Yes. It's a watershed analysis for the three outfalls at Apogee that were in question. What -- the historical flow data at the site was collected based on monthly DMR reports. So the client's contract laboratories go out and they estimate flow. These outfalls are typically just spillways, so they don't have any flumes or sophisticated flow measurement devices, so there's less accurate flow information, basically.

And the second thing they didn't have was when you design any kind of a treatment system, you need to understand the variability of flow. So while they had reasonable kind of base flow data from when they went out and observed the outfall, they typically weren't out there in storm events. So we really needed to see -- and because these are steep hills,

large watersheds, storm events -- particularly large storm events generate an enormous quantity of water. So we needed to estimate that.

So one way that you can do it is you can literally go out and set up, you know, these flow devices and monitor for a very long period of time, because you really want to get seasonable variation and you're kind of at the mercy of Mother Nature to provide big storms that can take months sometimes.

So the alternative approach is we did this modeling where we had the watershed volume and we used runoff coefficients to estimate both the storm flow and storm flow peak flows and so that we could take this information and better understand how to design conceptual systems around that flow.

Q. When we talk about flow, that's the amount of water that comes out of the -- comes off of the mountain --

A. Yes.

Q. -- down through the --

A. Yes, seeps out of the mountain and down the surface.

Q. Looking at page 2 of the report, you all have a Table E1. Could you -- first of all, Outfall Number 1 is the largest. That's the Slab Fork outfall?

A. That's correct.

Q. Okay. And Outfall Number 2 is Mud Lick?

A. That's right.

Q. And Outfall 3 is Titanic, correct?

A. Yes.
Q. Next to that you have -- for example, Outfall 1, it says 750/1600.
A. Right.
Q. Am I correct that the 750 gallons per minute is the annual average base flow?
A. Yes, that is the average flow that was measured from their DMR reports for that year.
Q. Okay. And then next to it, you say design average flow. What is the design average flow?
A. When our engineers evaluated the flow, the preceding year was a drought year and there was some concern that we might be underestimating the flows from that data, and so they used -- kind of added the annual storm runoff estimated for a typical year into those calculations.
Q. Okay.
A. So kind of a safety factor basically that we put in there, understanding there was some uncertainty in the flow data.
Q. Look at page 10 of the report, please.
A. Okay.
Q. Could you explain to the Court what this graph signifies or what it is.
A. I'm sorry. I jumped from 9 to 11 here.
THE COURT: I'll let him have the exhibit.

MR. HURNEY: Thank you, Judge.

THE WITNESS: Thank you.

MR. HURNEY: And I believe I've discovered that I've taken copies of documents and given them to the witness, so I apologize.

BY MR. HURNEY:

Q. Okay. I was -- before I got off-track, please look at the table. And I've stuck it up on the machine. What does that table signify and where does it come from?

A. What this is is data specific to a meteorological database for Charleston, West Virginia. It's called an exceedance curve for daily rainfall. And essentially what it is, it's from 1970 to 1996. It's, you know, 26 years' worth of data where they've taken -- at every day that there is a rain event, they've measured how many inches of rain resulted in that 24-hour period.

And so if you look at this curve, just for an example, if you kind of go up at the --

Q. Could you step over and just kind of point at that.

A. Sure.

Q. That would help, so we understand a curve.

A. So your percentage exceedance, zero to a hundred, and then this is the amount of rainfall in that 24-hour period. For example, a half inch, 1.5 inches of rain in that 24 hours. So basically if you were just to go up maybe this 8 percent

level, it would say that only 8 percent of rain events exceed 1 inches, 1 inches of rain in a 24-hour period. So obviously the larger the storm event, the less frequently they would happen.

Q. Okay. And identify that as Exhibit Number 4?

A. Yes.

Q. All right. Let me ask you to look at Exhibit Number 5.

A. Okay.

Q. All right. What is this document?

A. This document is where we took the basis that we developed in the storm water watershed modeling analysis and combined it with the characterization work that we did, and there's one other document that came out about this same time that's called the design basis document.

Q. We'll locate that document.

A. Yeah. And so really what we wanted to do is the focus of this report was to compare technologies that treat selenium from a cost perspective, the pros and cons, those kind of things, to help the client make the decisions on what seems to be an appropriate approach here. So to do that, you need a design basis. You need to understand the range of chemical characteristics, flow ranges, those kind of things.

And so we -- of the three outfalls we analyzed, and because we really wanted to proceed quickly on schedule, we agreed to evaluate in this report only the Outfall 002. And

the reason we did that, it was the middle flow outfall and it was also the outfall that has the highest average selenium concentrations, with the understanding if you go above and below that, in general the technology evaluation should hold relatively true.

So that's really what this document does, is it talks about how we evaluated cost and technologies and how we would put that into a system at end of pipe.

Q. And are these preliminary evaluation costs?

A. I'm sorry?

Q. Are these preliminary evaluations of cost?

A. At cost?

Q. You have --

A. Yes.

Q. If you'll look at -- yeah, I'm sorry. Look at page --

A. Okay. Of cost? Yes.

Q. You've looked -- and across the top, I wrote the various technologies that you evaluated.

A. Yes.

Q. Okay. And which technologies did you look at?

A. We looked at Alternative 1A and 1B are two zero valent iron technologies. We evaluated those two specifically. "SS" stands for ShipShaper, a company that Patriot Coal had been working for before we started working with them. And then MATRIC was a competitor, had another variation of the ZVI

technology that was working on-site.

The second alternative is reverse osmosis, third is ABMet, which is a proprietary GE biological system. FBR is a fluidized bed reactor. It's another form of a biological system. And then the final alternative was a sub-surface wetland flow passage.

Q. You have kind of cost estimates on here. And is the backup data for your cost estimates contained in the cost appendix --

A. Yes.

Q. -- at the end?

A. Yes, it is.

Q. There's been some discussion of Class 5 cost estimates. Could you explain what a Class 5 cost estimate is.

A. Yes. When you develop a cost estimate, you can only be as accurate as the design information that you have. So at this stage, we were very conceptual. We have maybe 1 or 2 percent of a design of a real system put together. So you don't have hard data on the specific size of the equipment that you need to have, what are the infrastructure issues that you may have to construct, what equalization capacity you have to address. So it's used at a high level, a magnitude more for comparing technologies. And as you can see in this case, these estimates, Class 5, they're plus 100, minus 50 percent.

So if you looked at Alternative 1A that says $22 million

capital cost, the accuracy of that estimate would be expected to be up to twice that or, on the low side, half of that.

Q. Pretty wide swing?

A. Yeah. Yeah.

Q. I take it a Cost 3, 2, 1 estimate would be more accurate?

A. Yes.

Q. And do you get to those cost estimates as you get farther in and actually decide what technology you're going to use and how you're going to install it?

A. Yes. Once you select the specific site, the specific flows you want to treat, the specific site conditions that you may have to, you know, excavate significantly, those kind of things, so as you move down the process of more and more detailed design, getting firm bids from contractors, those kind of things, that the range and variability narrows.

Q. Okay. I think I've located the other document. Let me hand you Exhibit Number 2 and ask you to look at that.

That's Joint Number 2, Your Honor.

A. Yes. This is the basis design document I talked about where we took our flow and chemical characterization information that we collected prior to this and then developed a design basis for Outfall 002 flow specifically as the basis of this conceptual engineering alternative Exhibit 5.

Q. Okay. Now, going back -- first of all, Your Honor, at this time I don't believe we've moved the admission of Exhibit

Number 2, and I would move the admission of that. And that's in our stack of joint exhibits.

THE COURT: All right. Any objection?

MR. LOVETT: I have no objection to the admission of any of the joint exhibits.

THE COURT: All right. We'll consider all the joint exhibits which are offered to be admitted by stipulation. I don't seem to have the page 2.

MR. HURNEY: I'll see if I can dig one up for you, Judge. I'm actually going to move back to Number 5.

BY MR. HURNEY:

Q. Looking at Number 5, this is the document where, am I correct, that CH2M Hill dug in deeper to potential technologies that could be employed for the removal of selenium at -- and I know you used Outfall Number 2, but for removal of selenium in outfalls at the Apogee Mine?

A. Yes. Again, that first small study we did was devoid of any water quality data or flow data. So this was a refined version.

Q. All right. Now, in this report, can you look -- we talked about the cost estimates in the other report. Are the technologies that you listed as -- listed Class 5 cost estimates for the same technologies that are discussed in more detail in this report? (Indicating)

A. I'm sorry. Say that again.

Q. Okay. I guess I just wanted you to review for the Court that this report discusses in more detail various technologies to be evaluated; is that correct?
A. Yes, that's correct.
Q. Okay. And in terms of proceeding with technology, what technologies did CH2M Hill recommend that Patriot continue to explore?
A. Two that I know of, to look back to our recommendations, was the FBR, fluidized bed reactor technology, and also the MATRIC ZVI media system.
Q. Now, as I understand it from your report, there were other contractors that Patriot was dealing with with respect to the ZVI technology, correct?
A. That's correct.
Q. Okay. You all were familiar with it, but you were not running that technology.
A. That's correct.
Q. All right. So did you at some point start a -- well, let me ask you this. Let's do it this way. What was the next thing -- after this report, what was the next thing that CH2M Hill did for Patriot Coal Company?
A. We supported a technical evaluation of VSEP technology, a kind of a membrane, reverse osmosis membrane technology by a company, New Logic Research. And I learned that they had been involved in the process in litigation prior to our involvement

and had claimed that this would be the best technology to apply at these sites. So we assisted Patriot in helping them develop a pilot plan and provided oversight and final report review of the VSEP system. So that kind of -- about the time we wrapped this up is when we started to change our focus to provide support on VSEP.

Q. Okay. And just to be clear, VSEP, is it a variant of reverse osmosis?

A. Yes, it is.

Q. Okay. Had you recommended VSEP in your initial evaluation of technology?

A. No, we didn't.

Q. All right. I'd like to hand you Exhibits 6 -- Joint Exhibit 6, 7, and 8 and ask you to look at these documents.

A. Okay.

Q. Are you familiar with those reports?

A. Yes.

Q. And what do they relate to?

A. These are CH2M Hill's review comments on New Logic Research reports. They submitted two reports after they completed their --

THE REPORTER: "After they completed their"?

THE WITNESS: Technology evaluation. I think that's it.

THE COURT: Scoot just a little closer to the

microphone.

THE WITNESS: I'm sorry. So they submitted two reports, the actual summary of their pilot study and what they claimed that it found, and they also submitted a budget report on how much this technology would cost. And then the third one after we submitted our comments, they responded with an additional set of comments, and this was our final response.

BY MR. HURNEY:

Q. Okay. On our timeline, could you tell me when the planning from your report -- tell me about -- I assume there was some planning that went into doing this pilot and then the pilot itself and the subsequent comments. During what time period did that stuff occur?

A. Well, the initial discussions on a project, my recollection, was in about February --

Q. Okay.

A. -- of 2009.

Q. All right.

A. And then I'm sure there was probably two to three months of planning, and I probably have it on my sheet here.

Q. Okay. If you could look at your cheat-sheet, I'd like to give the Court an idea of the dates. We had some testimony yesterday, but could you tell us what the dates of the pilot project were?

A. It looks like as far as actually being in the field and

operating, it started the very end of April 2009.
Q. What was that date?
A. April 27th.
Q. All right. And when did it end?
A. It appears August the 28th. Yes, August 28th, so it was about a four-month pilot study. That was the goal, that it be a four-month study.
Q. All right. And you issued a report to Patriot with your comments on the VSEP technology, correct?
A. On their reports.
Q. And those are the three reports in front of you?
A. That's correct.
Q. All right. Now, were you aware that GE was performing pilots of RO and ABMet?
A. Yes, I was.
Q. Okay. Did you all have any involvement in doing those projects?
A. No.
Q. Does CH2M Hill have anything to do with the GE RO pilot system?
A. No.
Q. I thought you had designed one of the systems for GE.
A. I understand -- I wasn't involved in that, but someone in our company helped them kind of scope out the technical components that a pilot system needed to be for an ABMet

system.
Q. All right. Let me ask you a question. We've been talking about pilot systems for the last couple of days. You know, for example, you did an FBR pilot. What exactly is a pilot system?
A. It's a system that, you know, you collect the data to try to mimic what would happen in a full-scale system. It's kind of an early evaluation where you have -- typically like to have a continuous flow of the actual wastewater you want to treat where you're adding the chemicals and the equipment and process that you would treat those in at a smaller scale, and you can learn quite a bit on how to scale up to the larger system and what other additional problems that you might find before you go to the effort and expense of installing a full-scale system.
Q. Now, at some point did you all -- did Patriot ask you to embark on a pilot project related to the fluidized bed reactor?
A. They did.
Q. Okay. And when was that?
A. Those discussions started in August of 2009.
Q. Let me ask you to look -- could you find the fluidized bed reactor report --
A. Yes.
Q. -- dated -- I have dated July 2010.

A. Yes.
Q. Okay. What exhibit number is on that?
A. 46.
Q. Is that just Exhibit 46?
A. Yes.
Q. Or is it Plaintiff's?
A. Oh, I'm sorry. Plaintiff's Exhibit 46.
MR. HURNEY: Okay. That's already been admitted, Your Honor.
THE COURT: All right.
BY MR. HURNEY:
Q. Is that the report that relates to the fluidized bed reactor study?
A. Yes.
Q. Okay. Could you tell the Court, you know, starting with the -- kind of from start to finish when you performed that -- you know, when you started planning, when you were in the field and when you ended that pilot study?
A. Yes. We were in the planning stages with the client on that and other projects, a storm water project as well, in August. They -- so through that planning and refinement period and development of kind of the scope of work took us into October, late October of 2009.
Q. Okay.
A. And then at that stage until we mobilized in the field,

so from October until early February is when we were actually in the field and installed and started up the pilot, and we ran the pilot until June 1st.

Q. All right. And does the report -- the fluidized bed reactor pilot report, is that what you submitted to Patriot to report on this pilot?

A. Yes.

Q. Do you recall when you -- you submitted a draft report to Patriot and then a final report?

A. That's correct.

Q. Do you remember the date of the final report?

A. I don't remember the exact date. I believe it was around the 27th of July.

Q. Okay. Prior to that, you sent a draft. Is it typical in your company or in your business to give a draft report before the final?

A. Very common.

Q. You have discussions with the client and then issue the final report?

A. Sure. They have questions and want clarification on things.

Q. Okay. Now, you mentioned a storm water evaluation. Was that evaluation recommended in your technical memorandum of January 26? Look at Exhibit 5, page 3, for flow monitoring and sampling equipment.

A. Yes.
Q. Okay. Now, you indicated that that was January of 2009. Was it August -- when did you start -- when did Patriot ask you to start putting that together?
A. At the same time as the FBR pilot.
Q. Okay.
A. So we had those discussions in August of 2009 and were given the go-ahead in November or late October.
Q. All right. Get the go-ahead? In other words, they said proceed with the study?
A. Right.
Q. All right. Walk the judge through -- by the way, that study is ongoing as we speak?
A. Yes, it is.
Q. All right. Could you walk the Court or could you tell us the progress of that study? You know, what happened from the time they told you to do it up until you have people in the field now?
A. Sure. Basically the concept of the storm water study is we wanted to evaluate flow with precise flow instrumentation for a period of about a year. The reason for that is we wanted to understand, you know, base flow, peak flows, seasonal effects of flow. And also in correlation with that, we really wanted to understand how selenium concentrations change during a storm event, because from a sizing and design

and cost perspective, large storms really drive everything, and so we really wanted to understand it as you would intuitively expect that selenium concentrations would decrease during a large storm event. And we needed to understand that.

So the actual process then is after we were given the authorization to proceed, we immediately set a site meeting, got in the field at this activity -- the project they wanted to have take place at the Hobet site. So we spent a few days on-site with Jim Constant and the mine manager staff looking at potential outfalls that we could use for this study.

They had to be -- meet some pretty specific requirements. One, it had to have selenium at a higher level so that we could really understand and see within that range if we're getting some dilution. It had to be an easily accessible, safe location for our sampling staff to fix -- or to be there. So those are some of the things.

And then once we came back, we had to then, after we selected two outfalls to do the study on, we then had to go back and we had to develop weir sizing based on kind of doing other modeling exercises --

Q. Let me stop you. What's a weir?

A. I'm sorry. A weir is a mechanical device that measures flow. In this case it was a -- we have a V-notch weir at one location that has -- basically what it is, is you put a vertical barrier in the stream and then the water will build

up behind that, and then there's a notch -- a V-notch in this case -- and it will spill over. And based on the height of flow above the bottom of the V-notch, you can do hydraulic calculations to get the flow rate. And so the other part of that was then we had to install a transducer, the flow measurement pressure device in a well in the stream, and a data logger, so that basically we now, since June 1st at one of the outfalls, we have continuous flow data where we'll take flow, rain, and pressure every five minutes continuously, 24 hours a day.

THE COURT: Can I interrupt just so I can keep the timeline? You said that you had conversations with Patriot in August of '09 --

THE WITNESS: Yes.

THE COURT: -- that led to both going ahead with the FBR study --

THE WITNESS: Yes, sir.

THE COURT: -- and also going ahead with this flow study.

THE WITNESS: Yes.

THE COURT: And then starting in August, your company started taking the steps that you've described now in particular about going out and picking the outfalls you wanted to examine, installing the devices and so forth.

THE WITNESS: Yes, we had -- the early period

between August and October, we had submitted a high-level scope basically to get agreement from the client. And I think they also wanted input from West Virginia DEP, if they thought they were appropriate projects. So once that was defined in October, then we actually mobilized to do the work.

THE COURT: Well, as I understand it, you gave them a report in late January of '09 where you specifically made the recommendations you're --

THE WITNESS: That's correct.

THE COURT: Do you know why it was not until August that you had conversations with them to implement those recommendations?

THE WITNESS: I don't know. I know that our focus at the end of that January period was to focus on the VSEP technology.

BY MR. HURNEY:

Q. By the way, there was some testimony that it's pretty simple to do two or three pilots all at once. Could you explain the process of doing a pilot study, what it involves and whether it is easy to do a bunch of pilots in parallel?

A. It's definitely more difficult and challenging to do pilots in parallel, particularly when you're -- I mean the basic process for the FBR, for example, was an 8-gallon-a-minute system. So you have to work with the equipment vendor that provides that technology first and identifying a

subcontract with them. You have a range of chemicals, granule activated carbon media, other things that you have to procure. You have to subcontract with laboratories to do, in this case, selenium analysis, which we wanted to have done at a specialty lab in Washington State, as well as the basic parameters.

You have to have field staff. We ran these 24 hours a day for a period of four months. So we had field engineers on there eight hours day, seven days a week. And because you want to have a good understanding, so we selected a large range of data daily. We had an on-site lab where we were testing. We couldn't test selenium because of the specialty method, but most of the other parameters we had an on-site lab where we did that testing.

So, you know, subcontracting, multiple -- if you extrapolate that to more than one pilot, then you would have to work with a different technology vendor typically, identify more staff that were available to support being in the field for four months in a remote mine site, those kind of things. It's more juggling.

Q. So it's not just pick up the phone and say, "Hey, can you run over and do a pilot for us?"

A. No. It's involved to get prepared for that.

Q. You all -- I take it that your storm water data, you're not at a point where you've done any analysis of that at this point. Is that fair?

A. We've done -- we've gotten one small storm actually last Friday that we have gotten our first storm collected.
Q. Okay. So at present, what are the -- well, let me ask this. Go back to the Exhibit 5, please. And the judge asked you a question about some recommendations, and I do want to talk to you about other recommendations in this report. And it appears to me that these same recommendations are contained in the other reports issued that same day. Is that your recollection?
A. Yes.
Q. Okay. So in other words, the first -- the first bullet point on page 3 is to consider regulatory relief options with the West Virginia DOH.

Is it fair to say that that was a recommendation that you left to Patriot to pursue?
A. That's correct.
Q. Okay. And the other was -- the second one was to discuss or initiate discussions with the West Virginia Department of Environmental Protection about the quantity of water to be captured and treated.
A. Yes.
Q. Was that something you left to Patriot?
A. Yes, it was.
Q. All right. We've talked about the appropriate flow monitoring and sampling. Am I correct that that's the study

that's ongoing at present?
A. That's correct.
Q. All right. Did you -- the next one is confirmation testing on the FBR system. Has that been done?
A. Yes, it has, this report we're talking about.
Q. Okay. And then looking at the next bullet point on page 4, is that related to the FBR as well?
A. Yes, it is.
Q. All right. And the next bullet point is -- relates to MATRIC ZVI. Was that something CH2M Hill was going to do, or did you leave the relationship with MATRIC to Patriot?
A. They had that relationship. We weren't involved.
Q. Okay. And the last was in-situ biologic development. What is that?
A. The idea there is what happens that causes selenium in the natural ground to move is when it's excavated and blasted and moved, basically it's exposed to oxygen and water. So it's an oxidation process that starts and converts selenite or reduced forms of selenium to selenate, which is very soluble and starts to move in the water.
So what you do with in-situ treatment -- and a lot of times you'll see this kind of technology in, say, hazardous waste, like cleanup and so forth, where they'll actually go in and inject chemicals in the ground either to oxidize it or reduce contaminants of concern.

So in this case, you would -- the idea is no matter wherever it's been done, but you would go into, say, a valley fill where you knew the source of selenium was, you would inject some kind of a reducing agent or some material to bind up the selenate to keep it from mobilizing in the groundwater.

Q. Do you know whether Patriot is working on any pilot projects on that, in that regard?

A. I understand that they are working with Dr. Ziemkiewicz from West Virginia University to look at ferrihydrite, I believe.

Q. And is that something that CH2M Hill is involved in?

A. No, we're not.

Q. All right. Let me ask you to turn your attention to the FBR report. And I guess what I'd like to know is in your report that was delivered at the end of July, what was your recommendation to Patriot? What was the next step recommendation of CH2M Hill?

A. The -- when we first set out to do this pilot study, it was really a proof of concept. We, CH2M Hill, believed that it would be an effective technology because selenate is similar to other contaminants that FBR is well-proven for, I think nitrates and chlorates. And so really the concept was -- and to our knowledge, an FBR hadn't been used to treat selenate in a mining or other setting, so -- and due to our prior work where we did our conceptual evaluation and cost

estimates, it seemed to have a cost advantage to us in our calculations considerably.

So the first step was really just to prove that out, that we could achieve selenium to below the limits with this technology. So the recommendation out of that, though, was now considering that you might have to go into a full design of the system, there was some areas particularly related to pretreatment and post treatment that weren't evaluated as part of that scope. It wasn't the original intent.

Q. Okay. Have you been directed just this Monday to take further steps as it relates to FBR?

A. Yes, we have.

Q. Okay. And what are you doing?

A. Two parallel activities. The first is to develop a cost estimate schedule to install three FBR units at the three Apogee outfalls and then a parallel cost estimate schedule if you were to install one centralized system at the Slab Fork outfall and then convey water from the other two outfalls to that centralized system.

So the cost estimate development task is one of the tasks we received Monday, and the other was to develop a formal proposal to implement FBR technology at the outfalls.

Q. When do you expect to respond to Patriot?

A. Well, I just found out yesterday -- or Monday, so -- but on the cost estimate, I'm --

Q. Can we get it by five today? Do you have a ballpark on when you'd get back?
A. On the order of two to three weeks for the cost estimate.
MR. HURNEY: Your Honor, I'm going to move to another area.
May I move the admission of Defendant's Exhibit 4, which is Mr. Harrison's CV?
THE COURT: It's admitted.
(Mr. Hurney, the Court, and Clerk conferred privately off the record.)
BY MR. HURNEY:
Q. I'd like to hand you what has been marked as Plaintiff's Exhibit 63. Do you recognize Exhibit 63?
A. Yes, I do.
Q. What is Exhibit 63?
A. It's a Microsoft project schedule, chart, that depicts the general schedule for installation of a centralized FBR system at the Apogee site.
Q. Okay. Did you prepare that schedule?
A. I did, in conjunction with others. It was kind of a team development between Tom Sandy, Bill Shively, and I from CH2M Hill and John Koon, the plaintiff's engineer.
Q. And when did this occur?
A. It was last week.
Q. Okay. Now, who is Tom Sandy?

A. Tom Sandy is the senior consultant on all of the selenium work we've done for Patriot Coal. He's our senior technologist.
Q. Who is Bill Shively?
A. Bill Shively is one of our senior project delivery directors that has extensive experience in designing and construction of industrial wastewater systems.
Q. How much time does that schedule allow in total for the construction of an FBR facility, a single FBR facility to treat the effluent from Titanic, Slab Fork, and Mud Lick?
A. Approximately two and a half years.
Q. Okay. Putting -- and I guess I want to back up. If you were to schedule that project, about how long would -- you know, from CH -- this is -- I'm not talking about this. This is kind of a collaboration?
A. Correct.
Q. Fair? But absent a collaboration and two years, six months, did you come to a conclusion about how long you thought this project would take?
A. We did. We had Bill Shively evaluate it, and his scheduling was three to three and a half years from start to being in compliance.
Q. Okay. We had discussions over a big part of the day and came to two years and six months. Do you think that's a reasonable amount of time?

A. I would say it's a schedule that if everything goes flawlessly, it can be achieved, but there's not contingency built in, which is typical of construction projects.

Q. Could you give me an example of how you build a contingency into a construction project?

A. You just build in additional schedule for areas of uncertainty. In this case, you know, as of last week, we really weren't even thinking about, you know, an approach where we have a centralized system. So we really had to think through it. But permitting is very uncertain. You're relying, depending on the kind of permit you have, on West Virginia DEP, Army Corps of Engineers, U.S. EPA.

We also don't have any understanding of the geology there. There hasn't been a geotechnical evaluation to understand if special foundation supports need to be put in. There's risks around. In this particular technology, you rely on vendors to build and deliver large process equipment that has long lead times of when they receive a PO on the order of eight or more months from the time they're told to construct these. These are not items that are sitting on the shelf. So you have to have them built.

So if, you know, they were delayed in schedule or something happened at their plant, it rolled off a truck -- you know, this assumes that everything can be done well.

One of the biggest concerns that was identified from our

team relates to the fact that the valley is so narrow there that there's not adequate space. We're estimating that something like that would probably be on the order of one to two acres. So we would have to go in and basically cut a bench out of the mountainside there. And just the current one-lane road that goes up to the site, you may have to run trucks 24 hours a day for a period of a month or two to get the material out of there to excavate these needs.

Q. And my recollection is -- and I think Dr. Koon testified he thought it could be done in closer to two years, and you're kind of over three. But after back and forth with the engineers, you guys came on two and a half years?

A. Yes.

Q. And have you all continued to drill down on detail and planning to achieve the two-and-a-half-year schedule?

A. We have continued to look at that.

Q. And who's handling that?

A. Bill Shively and one of our construction schedulers by the name of Bill Hill.

Q. Okay. And are they actually going out and -- give me an example of something that they're doing to drill down that schedule.

A. They're just laying down the more specific tasks in much greater detail. So as opposed to saying, you know, a site/civil design, they break that down more specifically into, you

know, earth work, foundations, those kind of things. So when you lay out -- and what BOP here stands for is balance of process. That's kind of all the stuff related to the wastewater process, treatment equipment and so forth. So you actually get to the point where you're laying down specific equipment items, electrical requirements and so forth, and so when you drill down, you can get a better understanding of where your risks are and what your procedure is.

Q. And is this -- is this all towards cementing the proposal like that Patriot can expect as to this project and its cost and how long it will take?

A. Yes. You know, as an engineering firm, when you accept a project, you want to -- you don't want to accept -- take on unacceptable risk, and so you really need to identify what those are, whether -- you know, if we don't believe that we can do it any sooner, we'll potentially not bid on the project.

Q. Now, when you were retained by Patriot, you understood that they were under consent orders to get things done?

A. Yes, I did.

Q. Okay. Am I correct that you weren't aware of specific dates on which they had to be in compliance?

A. That's right. We weren't involved in any of the litigation support or anything like that.

Q. Okay. Now, looking back on this schedule, do you feel

like CH2M Hill proceeded with some urgency in recommendations and proceeding with tasks?
A. Yes, I do. I think, for example -- and Patriot as well. When we received -- or we submitted proposals, they would typically be approved and funded within a matter of days.
Q. Putting aside whether you could have done some things in maybe a little bit shorter, do you feel like since July of 2008 till now that you've accomplished a great deal?
A. Oh, yes. We had -- we've closed a lot of the data gaps; had very low understanding of the selenium in this environment, the flows. So we've learned a great deal, technologies that show promise and those that don't.
Q. I mean has all the work you've done put you in a position to make a proposal to actually construct an FBR facility that, you know, will bring Patriot into compliance?
A. Yes.
Q. You needed that work to get to that point. Is that fair?
A. Yes.
MR. HURNEY: Your Honor, at this time I don't have any further questions.
THE COURT: All right. Before we start cross, let's take a few minutes here and sort out these exhibits and make sure that we've got the right copies with the right people.
MR. HURNEY: I apologize. I thought I was --
THE COURT: Let's sort it out before we start the

cross.

(Counsel and the clerk conferred privately off the record.)

THE COURT: All right. Are we ready to resume?

MR. LOVETT: Yes, Your Honor.

THE COURT: Okay. Mr. Lovett, go ahead.

CROSS EXAMINATION

BY MR. LOVETT:

Q. Good afternoon, Mr. Harrison. How are you today?

A. Good. How are you?

Q. Let's talk a little bit about the schedule. Mr. Hurney asked you about the two-and-a-half-year schedule.

A. Yes.

Q. That is a schedule -- I guess now the cat is out of the bag and we're no longer trying to have any confidentiality from settlement negotiations; is that right?

MR. HURNEY: I actually think you introduced it. We could talk about the engineer-to-engineer stuff. I wasn't planning to talk about any of the discussions that counsel had with respect to settlement. I thought we were struggling --

MR. LOVETT: I wasn't going to talk about any of our settlement stuff. Don't worry about that in terms of this schedule and the cost estimates. You won't object to my questions?

MR. HURNEY: I'll have to listen to them first.

BY MR. LOVETT:
Q. Okay. So this schedule was worked out at a meeting, I think you testified, with Dr. Koon, three or four members of the CH2M Hill staff, and a bunch of lawyers, right?
A. Correct.
Q. And during the meeting, the lawyers generally sat there and let -- I mean at least during this part of the meeting -- and let the engineers work on this schedule, right?
A. Correct.
Q. And as I recall, Dr. Koon had a much shorter schedule in mind in the beginning, and you all had a longer schedule in mind at the beginning; is that right?
A. Correct.
Q. And there were discussions, and I believe -- if this is wrong, tell me. But Dr. Koon persuaded Mr. Shively and you that the schedule could be shortened and tasks could be performed concurrently that may not originally have been in your schedule planned to be performed concurrently; is that right?
A. Yes, there were some --
THE REPORTER: I'm sorry. I didn't hear you.
THE WITNESS: There were some areas identified that we could tighten the schedule.
BY MR. LOVETT:
Q. And I don't think that was part of a compromise position

at that point, was it? That was just engineers talking about how to shorten the schedule, right?
A. Correct.
Q. And it's my understanding that at the end of the meeting, CH2M Hill concluded that it could install the FBR project at Apogee -- centralized FBR project at Apogee in this time period if asked to.
A. We believed that we could if we could address some of these unexpected things that, you know, you don't know until you get there.
Q. And you have those in any project, right?
A. Right, and that's why we build a contingency. In our -- Bill Shively's impression, this two and a half years doesn't include that.
Q. It does?
A. Does not.
Q. Does not? Well, I thought that during the discussions, that we said several times -- I think Mr. Shively or Mr. Sandy or yourself -- I can't remember who now -- said, "Well, we need a couple of months here to make sure that -- for any contingencies." And I think Dr. Koon said, "I don't know if you really need them, but it's okay." Do you remember --
A. No.
Q. You don't remember that?
A. There was no contingencies used in that schedule.

Q. Do you remember what Dr. Koon's proposal was?
A. I believe it was two years.
Q. Is that 106 weeks, maybe?
A. That sounds right, yes.
Q. And I think that based on what you've heard in the meetings with you all, he testified in length in that to 110 weeks during this hearing. Were you here for that testimony?
A. No, I wasn't.
Q. Now, this schedule has a lot of different points or dates at which projects are started and concluded and so forth. So if the Court --
A. Do you mean this schedule up here?
Q. Yes. No, I'm sorry, the schedule -- the two-and-a-half-year schedule that is Exhibit 62 -- 63?
THE COURT: 63.
BY MR. LOVETT:
Q. 63. I'm sorry. That schedule. There are timelines and dates by which certain tasks are accomplished, right?
A. Correct.
Q. And if the Court were to enter an order compelling compliance with a schedule such as this, it could base -- it could judge progress on the project by comparing these time-lines to what's actually happening on the ground; is that right?
A. Yes.

Q. Looking at this schedule now, do you have any particular concerns about the timeline?
A. Again, I think in my mind if things go as planned and there aren't any of these unexpected events related to permitting or special findings in the geotechnical evaluation, that this could be achieved.
Q. CH2M Hill does fast-track projects from time to time, doesn't it?
A. I expect so, yes.
Q. Does it have a different team to do fast-track projects, or would you be the team assigned to that?
A. It hasn't been defined yet, but there's probably a role for the existing team, but I'm sure we would be adding others.
Q. If you go to a fast-track schedule, you would add others, right?
A. Particularly from the construction end and that type of thing.
Q. Would this qualify -- this two and a half years do you think qualifies as a fast-track project?
A. I do, yeah. For an example, we're doing things like pilot study in parallel with preliminary engineering. So we're doing the design before kind of having all the answers.
Q. But I think that was pointed out that that's not a problem because you don't need those answers yet to do the preliminary work, right?

A. We can do it -- the bulk of it and modify it if the findings showed that we needed to change it.
Q. This is a reasonable schedule, isn't it? That's all I'm trying to point out. It's a schedule that your engineers agreed to in a meeting.
A. Agreed to with the contingency.
Q. I don't remember any -- the contingency has come since the meeting, hasn't it?
A. I'm sorry?
Q. The contingency that you're stating today is since the meeting. It wasn't something that was stated during the meeting, was it?
A. I don't recall if it was.
Q. Let's look at the exhibits that Mr. Hurney took you through first. Joint Exhibit 2, which is the basis of design memorandum --
A. Yes.
Q. -- that was produced on January 19, 2009; is that right?
A. Yes.
Q. And I'll turn your attention to page 9, which is the recommendation section. In January -- so the recommendation -- do you see that page?
A. Yes.
Q. So in January of 2009 you recommended that Patriot install appropriate flow monitoring and sampling equipment

near to better define the basis of design for three outfalls -- for the three outfalls of concern. Is that a recommendation?
A. Yes.
Q. Was that recommendation followed?
A. Other than the storm water study at the Hobet site, not to my knowledge.
Q. This recommendation is to understand the flow at the Apogee sites, isn't it?
A. Yes.
Q. That was not undertaken?
A. Not to my knowledge.
Q. And then you go on to say, "This will be crucial for properly sizing equalization capacity to manage storm flows and associated treatment systems." Do you see that?
A. Yes.
Q. CH2M Hill been tasked with any equalization projects by Patriot?
A. No.
Q. And as you said, that really can't be properly done until the flows are better defined, right?
A. It would decrease the uncertainty in sizing.
Q. And then you -- "In addition, CH2M Hill recommends collection of discrete sample selenium concentrations and other constituents of concern." Do you see that, the second

paragraph?
A. Yes.
Q. And did Patriot start doing that yet?
A. I expect that they have a number of these parameters as part of their monthly DMR monitoring.
Q. You knew that at the time of the report. You're not asking for more DMRs, are you?
A. That would increase the certainty around the selenium concentrations.
Q. Let me understand. I thought that this was the recommendation that they do the storm flow monitoring project that they're doing at Hobet that you just testified about. Is that not what this is?
A. This is not quite the same thing.
Q. Okay. What's different about it?
A. The project we're working on at Hobet really looks at trying to understand the correlation between selenium and storm flow.
Q. I thought that's what this says. "This data collection is recommended in order to develop correlations of storm flow and selenium concentration."
A. I'm sorry. Yes, that's right.
Q. Okay. So that is the project that's going on at Hobet now, right?
A. That's correct.

Q. And that started in April, right, of 2010?
A. The field work portion of it. Discussions were in August to start talking about that project.
Q. Do you know why there was such a long delay between this January 19, 2009 recommendation and the actual undertaking of the project?
A. I didn't have discussions with Patriot on that.
Q. And in your deposition, you said you never knew that Patriot had a compliance date of April 2010; is that right?
A. Yeah, we weren't brought into specific discussions on strategy.
Q. Right. And you never knew of any earlier specific deadlines that this Court had set for compliance. You never knew those compliance dates either, did you?
A. I knew they were in discussions, in litigation and dates associated with it, but not specifically.
MR. LOVETT: May I approach?
THE COURT: Yes, you may.
BY MR. LOVETT:
Q. Joint Exhibit 14. Have you seen this before?
A. Yes, I have.
Q. And it's a reprint of an article of which you're a co-author; is that right?
A. That's correct.
Q. This is from the SME annual meeting earlier this year?

A. That's correct.
Q. And what's SME?
A. I'm drawing a blank.
Q. Society of Mining Engineers?
A. Uh-huh.
Q. Now, as I understand it, CH2M Hill has not been tasked with any responsibilities regarding ZVI.
A. Other than to incorporate the sizing basis and cost basis into our conceptual evaluations.
Q. You haven't analyzed any reports about ZVI's effectiveness, have you?
A. No, I haven't.
Q. You don't know of any data that's really been compiled in a systematic way to show whether ZVI is effectively treating selenium to the water quality standard or not, do you?
A. I don't at the Patriot sites.
THE REPORTER: I'm sorry. I didn't hear that.
THE WITNESS: I don't at the Patriot's sites.
BY MR. LOVETT:
Q. On page 3, your article, under the heading "Biological anoxic and anaerobic heterotrophic attached growth" section -- do you see that?
A. Yes, I do.
Q. Second sentence. It says, "Two ZVI configurations were evaluated: ShipShaper and MATRIC."

A. Uh-huh.
Q. It says, "Each is in the early development stages."
A. That's correct.
Q. Is that still correct?
A. Though I haven't been involved, I understand they've tried new things, optimization of their systems, but we haven't been involved with that.
Q. So as far as you know, it's still correct.
A. I don't know otherwise. Yes.
Q. Okay. And in the conclusion of the paper on page 4, you say that the ZVI technology offered by ShipShaper was demonstrated in limited pilot studies to be effective for selenium removal under low flow concentrations.
Do you see that? It's the first sentence.
A. Under the Conclusions paragraph?
Q. Yeah, the first sentence.
A. Yes.
Q. That's not to say that it's been effective for removing selenium to 5 parts per billion or less on a consistent basis, is it?
A. I don't have the data to say that.
Q. Okay. And then you say, "It is infeasible for practical application for larger flows, such as 800 gallons per minute." Is that still your opinion?
A. Again, I don't know the recent improvements that have

been told on the kinetics, but I don't have information to conflict that.

Q. Okay. Well, you don't think that you could go out and install a ZVI system for 800 gallons per minute and make that work, do you?

A. Not necessarily 800 gallons a minute, but I -- it should be effective for, you know, flows of 100 gallons a minute.

Q. But just to remove selenium, not to necessarily remove selenium to 5 parts per billion, right?

A. I understand that there are facilities that have done that.

Q. Have you seen any data or reports substantiating that?

A. I believe that there may be reference to that in the North American Metals Council.

Q. At what site is that?

A. I'm sorry?

Q. At what site?

A. I understand that it's at a Monsanto site.

Q. Oh, a Monsanto site. Nothing having to do with mining.

A. I believe it's phosphate mining, but I'm not positive of that.

Q. Were ShipShaper or MATRIC involved with that?

A. I don't know.

Q. Okay. And it says in the second paragraph -- let me take

you to the last sentence of that. "Capital and O&M costs are significantly higher than for most of the other alternatives, and the technology requires a very large footprint." Is that right?

A. Based on the kinetics information they gave us, this would've been probably late -- early 2009.

Q. And you don't have anything since then, do you?

A. No, I don't.

Q. And then you say, "The ZVI technology offered by MATRIC was tested only in a laboratory-scale system and is reported to be effective for selenium removal."

Again, that's just removal of selenium, but not to any particular limit, right?

A. Yeah, I don't have the data on that.

Q. "It was not demonstrated in full-scale at high flow rates. CH2M Hill believes that the system is not yet engineered for full-scale application for the flows required, and there are many unknowns for full-scale application, such as hydraulic issues in the channel, plugging of media with precipitates and influent solids resulting in overflows in the channel," and so forth, right?

A. Correct.

Q. And you don't have any data since this to contradict that, right?

A. We haven't been involved, no.

Q. But you have been involved in testing every other system that is being considered by Patriot at this time, right?
A. The only -- VSEP and the FBR are the only pilot studies we've been involved in.
Q. You've had some on the ABMet pilot too, haven't you?
A. We were asked to do a cost estimate based on data they provided us to implement that at a full-scale.
Q. Now, in your deposition you testified that reverse osmosis -- I'm going to shift gears on you. You don't have to look at that anymore. You're welcome to, but --
MR. HURNEY: Your Honor, I object. I did not go into technologies with him. I limited his testimony to the projects that were done and when they were performed.
MR. LOVETT: I think you took him to Table --
MR. HURNEY: I just identified --
MR. LOVETT: You took him to Table 1, E1, of the Selenium Conceptual Treatment Alternatives Evaluation, which is a list of all the alternatives, including ZVI and RO and so forth.
MR. HURNEY: Correct. And I just asked him to identify them. I didn't go into detail with him about them, offering his opinions or testimony about the system and how it worked.
THE COURT: What do you intend to ask him about?
MR. LOVETT: Very quickly I'm going to ask him if he

thinks these alternatives -- I've just asked him about ZVI, and I plan to ask him if he thinks the other alternatives listed here are viable treatment alternatives for the Patriot site.

MR. HURNEY: Withdrawn.

THE COURT: All right. Go ahead.

MR. HURNEY: Sorry, Joe.

BY MR. LOVETT:

Q. RO-BC-BX, Alternative 2. Is that reverse osmosis?

A. I'm sorry. What are you looking at?

Q. I'm sorry. I'm on page 3.

THE COURT: Which exhibit?

MR. LOVETT: Joint 5. Selenium Conceptual Treatment. It's the December -- I assume the January 26, 2009 alternatives document.

THE WITNESS: I don't have that.

MR. LOVETT: Oh, you don't have that anymore? I thought you would have memorized this by now.

THE COURT: What page?

MR. LOVETT: Page 3, I think. Yes, 3.

BY MR. LOVETT:

Q. You've seen that Table E1 many times now in this case, haven't you?

A. Yes.

Q. Okay. So there are several alternatives, and we just

talked about ZVI ShipShaper, ZVI MATRIC, and so forth, and I was asking you about RO. RO is a very expensive treatment technology, right?

A. In this application, yes.

Q. And as I understand it, it may have some problems with fouling and scaling if appropriate pretreatment isn't concluded; is that right?

A. That's correct.

Q. Nevertheless, with appropriate pretreatment, there's no question that RO would achieve levels well below 5 parts per billion for removal of selenium in these applications; is that right?

A. We would expect if you design and operate them properly, they should be able to achieve that.

Q. How low can it go?

A. I'm not a membrane technologist.

Q. And then there's Alternative 3A, ABMet.

A. Right.

Q. That's the GE technology, right?

A. That's correct.

Q. And, again, that's less expensive and much less expensive than RO but more expensive than the FBR, right?

A. That's correct.

Q. And I think that the ABMet pilot was also successful at removing to significantly below 5 parts per billion; is that

right?
A. I did see that in the report.
Q. And so it was the opinion of CH2M Hill that ABMet would be an effective treatment technology in the applications at issue at Apogee?
A. One of the challenges with the ABMet is that its footprint is much, much bigger than an FBR.
Q. Uh-huh.
THE REPORTER: I'm sorry. You need to speak up.
THE WITNESS: I'm sorry, ma'am. The ABMet system had a much higher footprint --
MR. LOVETT: Right.
THE WITNESS: -- so you would have to excavate a much larger area to install it.
BY MR. LOVETT:
Q. How much larger of a footprint? Is it twice as big? I --
A. I submit two to three times as big.
Q. Okay. So it would require much more excavation.
A. That's correct.
Q. But once the excavation was done, it would treat the selenium to --
A. Yes. And the one concern about that report, that they didn't evaluate the other byproducts that are generated --
Q. Right.

A. -- like the BOD and so forth. So that would be important to understand so you don't create another problem.
Q. But those would be technical details that should be worked out without too much difficulty, right?
A. That should be able to be worked out.
Q. As I understand it, the reason that CH2M Hill doesn't recommend ABMet is because of cost, basically because of cost and footprint; is that right?
A. Yeah. Technologists could speak better than I, but those are two of the issues.
Q. Okay. Alternative 3B is the FBR, right?
A. That's correct.
Q. And that's what you're actually recommending now that Patriot use, right?
A. That's correct.
Q. And the FBR -- CH2M Hill is confident that the FBR will reduce selenium concentrations to below 5 parts per billion at these mining applications for Patriot, right?
A. Yeah, for defined flows and with the proper post treatment and pretreatment.
Q. Right. I understand. Do you know how much Patriot has paid CH2M Hill since it retained it in 2008?
A. Specifically for the selenium-related work?
Q. Yes.
A. It's on the order of $900,000, but we have contracted, I

believe, on the order of a hundred and twenty-five -- or, I'm sorry -- 1.25 million.

Q. Into the future?

A. Like for the storm water study and so forth that we're still working on.

Q. Now, as I understand it, CH2M Hill has been asked to provide a proposal just on this past Monday --

A. That's correct.

Q. -- for installation of a ZVI system -- excuse me -- for an FBR system?

A. Yes.

Q. And that's at Apogee or Apogee and Hobet 22?

A. I believe it's -- it's for the three outfalls at Apogee. There was not a Hobet request.

Q. You still have no request for Hobet 22.

A. That's correct.

Q. Have you talked to them at all about Hobet 22? Talked to Patriot at all about treating the flow at Hobet 22?

A. I believe other than it was brought up in the meetings last week.

Q. But that's it?

A. Yes.

Q. Okay. And what have you been asked to provide a proposal to do, to treat at a centralized system all the flow from the three sites?

A. Yes, at Apogee.
Q. And the design basis for that, is that the 25-year -- the first flush of a 25-year storm?
A. I don't recall specifically if we carved that out.
Q. That's what you all have recommended, though, in your January 2009 preliminary watershed flow estimation, right?
A. I'm sorry. Recommended what?
Q. The design flow be based on the first flush of a 25-year storm?
A. It wasn't really a recommendation. We were just trying to understand the breadth of the potential problem and the sizing issues.
Q. Now, CH2M Hill is -- how many employees does CH2M Hill have?
A. Approximately 25,000.
Q. And CH2M Hill could have, if asked, done pilots of VSEP and FBR at the same time, couldn't it have?
A. Well, there's a bit of overlap there at the end of the VSEP and the start of --
Q. But I'm saying if you had been asked, you could have assigned -- you have enough staff and resources, if asked, to do two pilot projects at once, right?
A. Yes.
Q. But you weren't asked, right?
A. Not until later for the FBR.

Q. You weren't asked to do the FBR pilot before the VSEP pilot, were you?
A. No.
Q. You weren't asked to do it while the VSEP pilot was going on, right?
A. I think there was a little bit of overlap.
Q. But you weren't asked to start it in March of 2009, for instance.
A. No.
Q. But you would have had the resources to do that had you been asked?
A. We likely could have found the resources.
Q. Now, I see on the schedule, the first part of it is a very short pilot, right?
A. Yes.
Q. And when I say the schedule, I mean the two-and-a-half-year schedule that you all worked out. What is that pilot for?
A. The pilot is designed to address the recommendations from the FBR pilot study report. Two of the fundamental issues were the suspended solids that come out of the FBR unit have selenium associated with them, and -- but we also then have to go into a second process to do aerobic treatment --
Q. Uh-huh.
A. -- to grade BOD --

Q. Right.
A. -- where we got a concern that we would reoxidize the selenium and then we wouldn't be able to capture it in the filter. So that's part of the issue.
Q. But you know that you'll be able to deal with it. The only question is, there are one or two ways that you could do it, and the pilot will tell you which of the two ways to deal with the problem, right?
A. The pilot is intended to understand the appropriate sizing and technology to address the problem.
Q. Well, why didn't you do that when you had the pilot project running?
A. That was the scope of our project and commitment.
Q. In other words, Patriot didn't ask you to do that.
A. Ask us to do what?
Q. To determine how to deal with the BOD and TSS issues that you're raising here now.
A. They did not.
Q. It would have been much easier to have done it then rather than now, right?
A. It would have been more efficient.
Q. Do you know why you weren't asked to do that at the time?
A. No, I don't.
Q. Now, you testified in response to one of Mr. Hurney's questions when he asked you how much you all have been doing,

you said, "We've closed a lot of data gaps between July 2008 and now." Is that right?

A. Yes.

Q. Do you actually -- do you know if the Court's order required closing of data gaps? Were you assigned to close data gaps?

A. We were assigned to help them understand how to solve selenium discharge issues.

Q. Now, I know you weren't here before lunch, but a witness here testified that Patriot's estimated selenium liability allocated $1.3 million to install the capital.

I'm going to ask him if he thinks that they could accomplish treatment at an outfall for $1.3 million.

THE COURT: All right. I'll allow it.

BY MR. LOVETT:

Q. So what could you do if you were given $1.3 million to treat the selenium at all three of these outfalls?

A. I don't quite understand the question.

Q. What treatment system could Patriot install at Apogee for $1.3 million that would treat the discharge from these three outfalls?

A. Treat all the discharge?

Q. Yes.

A. I'm not aware of any that would treat all the --

Q. That's a ridiculous underestimate of cost, right?

A. I don't -- I would need to understand the basis for it.
Q. Okay. Will a centralized system that you're designing return the water to Mud Lick after treatment?
A. We discussed that last week.
Q. And I just wonder, is that still part of the plan?
A. I believe it is.
Q. So the quote that you're getting would return the water to the streams from which it was taken.
A. Correct.
Q. How much of the project budget would you expect to be in the first 25 percent of the project schedule?
A. I believe 5, 5 percent, something like that.
Q. 5 percent of the --
A. Yeah.
Q. And what about in the second quarter?
A. Probably 5 to 10. And by quarter, you mean of the two and a half years?
Q. Yes, or the 110 weeks, whatever the schedule is.
A. Yeah, 5 to 7 percent.
Q. 5 percent in the first quarter of that, 5 to 7 percent in the second quarter?
A. Yes.
Q. What about the third?
A. 40 percent.
Q. 40? And then the last?

A. Whatever the difference is.
Q. Okay.
A. 30 or a little less.
Q. Okay. The paper that you authored for the mining engineers, was John McHale a co-author of that paper?
A. Yes, and he -- he reviewed the abstract that we developed.
MR. LOVETT: That's all I have. Thank you.
THE COURT: All right. Redirect?
MR. HURNEY: Briefly, Your Honor.

REDIRECT EXAMINATION

BY MR. HURNEY:
Q. You were originally retained in July of -- end of July 2008?
A. That's right.
Q. Okay. If at some point around that time you'd been told you had a deadline to have all three outfalls at Apogee in compliance, would CH2M Hill have been able to design, construct, commission, and build a system using FBR, RO, or any other technology?
A. And you're talking about how many months?
Q. When you were hired in the Fall of -- when you were hired in July or so of 2008, if you were immediately told that there was a June 30th, 2009 deadline, would you have been able to design, construct, commission, say, an FBR system?

A. No, we wouldn't have.
Q. If you had been told in, say, March of '09 that there was a new deadline of April 5, 2010, would you have been able to design, construct, commission an FBR system by that deadline?
A. And, again, that's just over a year it looks like?
Q. Yes.
A. No, we wouldn't.
Q. How about VSEP?
A. No.
Q. Is there any technology that you think CH2M Hill could have put in in that deadline?
A. No.

MR. HURNEY: I don't have any further questions, Your Honor.

RECROSS EXAMINATION

BY MR. LOVETT:
Q. And so I guess that means that Patriot didn't seek your advice about whether it could build a project between March 2009 and April 2010, right?
A. I don't recall ever being asked that.
Q. As long as we're asking hypotheticals, if you'd been told on March 30, 2009 that you had to install by March 30, 2011, could you have done that? Let me take it to March 2012, three years.
A. If we had three years to do this project?

Q. If on March 30, 2009 Patriot had come to CH2M Hill and said, "We've got to get this done in three years. It's just imperative or, you know, we're going to face dire consequences," could you have done that for them?
A. That seems more reasonable.
MR. LOVETT: Thank you.
THE COURT: All right. Any other questions?
MR. HURNEY: No other questions, Your Honor.
THE COURT: All right. You may step down, Mr. Harrison.
We'll take about a ten-minute recess.
(Recess from 3:15 p.m. to 3:35 p.m.)
THE COURT: All right. You may call your next witness.
MR. HURNEY: Yes, Your Honor. At this time I would call Thomas Sandy.
THE COURT: Mr. Sandy, if you'll step up here, my clerk will swear you in.
ARTHUR THOMAS SANDY, DEFENDANT'S WITNESS, SWORN
MR. HURNEY: I have Mr. Sandy's CV, which was inadvertently not supplied to the Court ahead of time. I have two copies. I'd ask to have it marked at whatever the next defendant's number is.
THE COURT: All right. That would be -- the last number I had for the defendant's unilateral exhibit is 14.

This would be 15.

MR. HURNEY: Number 15. I think that's --

THE COURT: I think that's right.

MR. HURNEY: I'll do a better job with my witness, Your Honor.

THE COURT: Actually, I think it's actually 11. Let's make it 11.

MR. HURNEY: May I proceed, Your Honor?

THE COURT: Yes, go ahead.

DIRECT EXAMINATION

BY MR. HURNEY:

Q. Would you state your name.

A. Arthur Thomas Sandy.

Q. Where do you work?

A. CH2M Hill.

Q. And what is your position with CH2M Hill?

A. I am the technology director for the industrial systems business group.

Q. What does that mean?

A. I direct and administer the 500 technologists in our business group related to the different markets that our business group does work in. So as an example, we have a water market that does industrial water or wastewater, and I direct people to projects to make sure we have the right technologists. I also help with best practices tools and

approaches to delivering projects.
Q. Mr. Sandy, I'd like to hand to you what has been marked as Defendant's Exhibit 11. Could you look at that document for a minute and tell me what it is.
A. This is my long resume.
Q. I had Tim Harrison on the stand and he had a two-pager. Do you also have a short resume?
A. I do.
Q. All right. So we have your long one. I'd like to first talk to you about your educational background. Where did you go to college?
A. I went to school at West Virginia University.
Q. Okay. And did you graduate?
A. Yes, I did.
Q. What year?
A. 1984 with a bachelors of arts in chemistry and in 1987 with a masters of science in engineering.
Q. All right. Do you have any special concentration with your masters of science in engineering?
A. I did. I focused primarily on industrial water/waste-water.
Q. All right. After you graduated in 1987, I take it you went to work.
A. I did.
Q. And where did you --

A. I was fortunate to get a job at CH2M Hill in Seattle, Washington.
Q. All right. When you started with CH2M Hill, what was your position?
A. I was a project engineer assigned to our industrial water/wastewater group.
Q. Could you tell us a little bit about what that means, an example of a project or a description of what kind of work you did?
A. Yes. As an example, as a project engineer we would support some of our subject-matter experts and industry experts in delivering solutions to technical issues that our clients would have. We would also support, design, and construction of infrastructure projects related to industrial water/wastewater.
Q. What is -- I think we've kind of talked about this term all week, but what exactly is industrial wastewater?
A. It's just merely a differentiation between municipal wastewater, municipal wastewater being sanitary wastewater. In our company we've separated the practice of technology from municipal to industrial. So we would do industrial water/wastewater work for the chemical industry, the petrochemical industry, the mining industry, food industry, forest products industry.
So we focus primarily on industrial water/wastewater. It

takes a subtly different skill set because of the uniqueness of the problems associated with each industry related to water/wastewater treatment.

Q. How long were you in Seattle with CH2M Hill?

A. I was in Seattle approximately five years.

Q. Were you an engineer the entire time?

A. I was.

Q. As an engineer, I take it you're doing the actual design, design work for wastewater treatment systems?

A. Yes.

Q. Operating as part of a team?

A. Yes.

Q. All right. Now, you were in Seattle for five years. Did you move somewhere else with CH2M Hill?

A. Yes.

Q. And where did you go?

A. Charlotte, North Carolina.

Q. And that's where you live today?

A. Yes.

Q. All right. Could you describe for us the position that you had when you started with CH2M Hill in Charlotte?

A. Yes. I was more of a mid-level technologist. I took a temporary duty assignment to Charlotte to work on several design projects related to synthetic/organic chemical fibers industries in that area. We were designing four wastewater

treatment plants, and so I was -- I moved to support those design projects.

Q. Okay. You're currently -- your current position as principal technologist, is that -- did you have a couple of ladders of promotion to get to that position?

A. Yes. We -- as Tim had said earlier, Tim Harrison, that within CH2M Hill there's different career paths you can pursue. We have a technology career path, we have a project delivery career path, as well as we've got a line management, business development career path. And so I actually -- I'm in the project -- certified project manager, but I also focus more on technology. So I've pursued the technology career path. And as you get to a certain level, there's senior, principal and fellow technologists, which is sort of the highest ranking technologists we have, and I am a principal technologist.

Q. You've reached the top of the CH2M Hill pecking order in terms of --

A. Not quite. A fellow technologist would be the top of the pecking order, but as an example, in our company we have less than 50 fellow technologists in a company of almost 20-some thousand people. So there's very few people that attain that position.

Q. I believe Mr. Harrison testified that you -- when you do a project, you have a project manager and you would always

have a technologist assigned to the project; is that correct?
A. We do. For project delivery, we assign a senior technical consultant to every project. And that role, it parallels very much with the project manager role, but the role of the senior technologist is really to support delivery from the technical side to make sure we're providing the right technical solutions. And that role specifically related to quality is we are responsible for reviewing, checking, and verifying the technical work that's done for projects.
Q. Okay. Can you give me some examples of projects in which you have been the principal or other technologist on? We know -- other than this particular project, but give us an idea of a couple of other things you've worked on.
A. Just recently or --
Q. Sure, just an example.
A. I am a senior technical consultant on a -- was a senior technical consultant on a coal gasification project where we were asked to develop a conceptual design for the water/wastewater treatment for a petro and coal gasification facility in Southern California.
So with that role, I was responsible for making sure that we prescribed the right water treatment processes for the feed water as well as the wastewater treatment for the gray water from the gasification process.
Q. When you said you picked technologies, like in this case

we've been talking about RO and other things, is that your part of the case, is to decide which technologies will work in a given application?

A. In part, yes.

Q. And what other responsibilities do you have?

A. Well, beyond picking the technology, we generally will ask subject-matter experts to -- if it's an area that we're not familiar with, to support a project. So if we need, say, as an example, a reverse osmosis expert, we will have a subject-matter expert help support the project of which I'll be involved in. But beyond just picking the right team and making sure we have the right people, I generally get involved in tools and practices, making sure that we're really applying the best practices standards of practice that would be accepted in the industry.

Q. And is that the role that you are taking in the projects that CH2M Hill has performed and is recommending for Patriot Coal?

A. Yes.

Q. Your CV suggests that you are a professional engineer in a number of states. What does that mean?

A. I'm licensed to stamp drawings, permits, where required, where there's a requisite for that, in the states of Washington, North Carolina, and South Carolina.

Q. Are you a member of any industry groups related to your

field?
A. Yes, I am.
Q. And what groups are those?
A. I am a member -- an active member of the Air and Waste Management Association and the Water Environment Federation.
Q. What is the Air and Waste Management Association?
A. It's a professional association of scientists and engineers that focus on, just as the name implies, air, solid waste, and water/wastewater and management thereof.
Q. There's been some -- I think admitted into evidence is a document from the NAMC.
A. Yes. That would be the North American Metals Council.
Q. Okay. Are you involved with that group?
A. Yes.
Q. And what is your involvement with that group?
A. CH2M Hill was contracted to do a project for the North American Metals Council, and I was the senior technical consultant for the work we did.
Q. Were you a co-author of their report on selenium treatment alternatives?
A. Yes, I was.
Q. And have you also authored other papers on selenium treatment alternatives?
A. Yes.
Q. Including one related to the use of various technologies

in the coal industry in West Virginia?
A. Yes.
MR. HURNEY: Your Honor, at this time I would move that Mr. Sandy be recognized as an expert in environmental engineering with experience in wastewater management and project management.
THE COURT: All right. You may proceed.
MR. HURNEY: Thank you, Your Honor.
BY MR. HURNEY:
Q. All right. Mr. Sandy, I want to -- we haven't -- were you involved with the -- when Patriot first retained CH2M Hill?
A. Yes.
Q. And could you tell the Court how you became involved.
A. I was contacted by John McHale and asked if CH2M Hill could respond to help them do an evaluation, a high-level evaluation of selenium treatment technologies.
Q. Okay. And -- okay. I was looking for a document. So you got the initial phone call from John McHale, or you called him?
A. Yes.
Q. Okay. Once they got in contact, what did CH2M Hill do?
A. Well, what I did was talk to John about the context of the project. You know, from a business standpoint, we want to make sure that we understand how they're procuring it, and we

do some kind of -- go through a decision process to decide whether to pursue it. So I talked to John to basically qualify what he wanted done and how they were planning on procuring the work. And then I engaged our project delivery director and some of our business development people to work on putting together a proposal or ultimately making a more formal decision on whether we should pursue the work or not.

Q. Okay. And ultimately did you all decide to take on the project?

A. Yes.

Q. Okay. And did you become the technical director for the project?

A. I was the senior technical consultant.

Q. Were you involved in the January 26th report that reviewed available technology?

A. Yes.

Q. Do you have a copy of that with you? Did you bring a copy with you to the stand?

A. I do not.

Q. Let me ask you if -- I'm going to hand you what has been marked as Exhibit 5 and ask you if this is the January report that discussed various treatment alternatives for Patriot Coal.

A. Yes, it is.

MR. HURNEY: Okay. And, Your Honor, this is Joint

5, which I believe has been admitted.

THE COURT: It has.

BY MR. HURNEY:

Q. Mr. Sandy, earlier there was another document that was provided to Patriot in November of 2008, and that's a screening level. Do you see that document?

A. Yes.

Q. And that's Document Number 3, correct? Exhibit Number 3? Look on the front page for the number of the exhibit.

A. This is Exhibit 3, and I was just -- there's --

Q. Appear to be some other stuff there?

A. Yes.

Q. I just wanted to ask you generally, was Exhibit 3 kind of the first pass at available technologies, kind of a -- I think Tim Harrison described it as a high-level review.

A. Well, this isn't -- this is the regulatory analysis. So this is not that document.

Q. Okay. I'm sorry.

A. That's why I was -- this says screening level, but it's really the -- it's in part one of the four things that we did in the project after we did the screening analysis.

Q. What I was trying to do is I talked to Tim Harrison about the various projects that you guys performed, and what I would like to do with you is to focus on your portion of the project, which I believe is the technology. Is that fair?

A. Yes.
Q. Okay. So if you would look at Exhibit 5, which is the conceptual treatment alternatives, is this the document in which CH2M Hill reviewed the available technology and described it to Patriot?
A. No.
Q. Okay. Is there such a document?
A. Yes.
Q. Are you looking at 5?
A. We did a conceptual -- this was more the focused treatment. So the conceptual evaluation we looked at a longer list.
Q. Oh, okay.
A. And the conceptual evaluation really focused on technologies that we thought were feasible based on the new information we got from the different outfalls as we were sampling.
Q. Okay. Well, let me ask you to look at Exhibit 5.
A. Okay.
Q. Okay. That was January 26, 2009. What is this document?
A. This is the conceptual alternative analysis for selenium treatment technologies as they would apply to the water that we characterized at the Apogee site.
Q. Okay. Did you -- and you chose Outfall Number 2?
A. That's the 800 -- yes, we picked that outfall because it

was sort of the median of the -- in terms of flow rates.
Q. Now, let me ask you, in this document, as I look through it, it appears on page 3 that you cost out a number of different treatment options, correct?
A. Yes.
Q. Okay. Now, and then as you go through the document, for example, on page 6 you describe an overview of pertinent reduction mechanisms.
A. Yes.
Q. Correct? All right. Now, just -- I just want to have an overview of the different types of treatment that CH2M Hill thought -- is it fair to say thought might be applicable to -- for use at these outfalls at Patriot?
A. Yes.
Q. Okay. When you talk about chemical treatment, what kind of systems are you referring to?
A. Well, we're referring to systems that would in some way either chemically adsorb or reduce the selenium. And so in this document, we in particular focused on zero valent iron because it's a viable technology that -- to reduce selenate. So it works through several different chemical mechanisms. So there's actually a reduction that can go on with zero valent iron. There's actually adsorption that goes on with zero valent iron. And so there's a couple mechanisms that actually -- there's actually three separate pathways that

selenate and selenite can get reduced to elemental selenium with zero valent iron, so --

Q. We've had testimony this week related to separate systems that were referred to as either ShipShaper, GMT, and Liberty/MATRIC. Are you familiar generally with those systems?

A. Generally, yes.

Q. Okay. You all -- CH2M Hill was not involved in the piloting or operation of those systems; is that correct?

A. Yes.

Q. Okay. Did you review those systems, however, in terms of your January 26, 2009 report?

A. We were given information on the systems at the time of their development.

Q. Okay.

A. So we took that information and then had to assess, you know, how would we put one of these in full-scale, so --

Q. It's true -- you've also described the strengths and weaknesses -- you described the strengths and weaknesses of ZVI in this report, correct?

A. We did, yes.

Q. And you described ZVI as a potential technology in a paper you wrote for the -- for a mining association meeting, correct?

A. Yes.

Q. Okay. And you also included it in the paper which you

participated for the NAMC, correct?
A. Yes.
Q. Is it fair to say that ZVI is a technology that can be used for the removal of selenium?
A. Yes.
Q. Okay. It was referred to by Dr. Koon as a fledgling technology. Do you believe that ZVI is a fledgling technology?
A. Yes. You know, if you define fledgling as -- how I would define fledgling in that context is I think what Dr. Koon was implying is that it's in the state of development. And, frankly, all these technologies are fledgling technologies, whether it be the biological technologies or the reverse osmosis, in the sense that we are trying to treat selenium to low levels which has never been done in full-scale in this industry at this scale. And we are applying technologies that albeit have been tried in other applications that aren't exactly this. So they're all really fledgling technologies in the sense that there's some development required to understand how they will perform and what you need to do to make them treat down to these low levels.
Q. For example, reverse osmosis is a technique that has been used in wastewater treatment for quite sometime?
A. Yes.
Q. Is it -- is it one that you are adapting or -- well, let

me ask this question to make it clearer. Put selenium aside. What do you use RO to remove? What kind of things does RO remove from water?

A. RO is typically used for taking, you know, ions out of water that can't be maybe treated otherwise, or in the case of probably more common use would be desalinization for drinking water as an example, where you're trying to remove salts from water.

Q. And it does it by forcing water through filters?

A. It does through membranes.

Q. Filters, membranes?

A. Right.

Q. Are you aware of the use of ZVI to remove selenium in applications outside of the coal industry?

A. Yes.

Q. Okay. And where's it being used?

A. It's being used in the phosphate mining industry in Idaho.

Q. Now, I believe your conclusion of that ZVI is that while it removes selenium, you question -- you question whether a passive system can be used at high levels of 800 gallons per minute and above?

A. Correct, yes.

Q. And -- but in terms of treatment of -- first of all, adequate for treatment of low flows under a hundred gallons

per minute?
A. Yes. A passive treatment with the right steps being done is part of the process. In any of these technologies, you have to purposefully control the environment to make the science or the science behind the mechanism that reduces the selenium work. So with the right pH and the right mixing and mass transfer, you know, there's -- zero valent iron has a potential to treat down to these levels.
Q. It is -- although at the end -- and I believe at the end of the day in January 2009, within the limitations that -- and I've used broadly -- needs work, that was a technology you thought should be continued for evaluation?
A. Yes, we -- that was our recommendation, was, you know, without being involved firsthand in what they were doing, was, okay, you're obviously into development; continue to develop that.
Q. Now, let me ask, could you describe for the Court -- you kind of went into RO. We talked about ZVI. Am I correct ZVI works by the chemical reaction between the water when it's in contact with the steel wool or the iron?
A. Yes, in part. There's actually -- with zero valent iron, there's actually three chemical mechanisms that go on, there's three things that happen, basically. There's basic iron as it's exposed to water with oxygen, it will rust. And so in the process, that's the first thing that happens, is you have

to remove all the oxygen first. And then what that does is the remaining iron is then there free to potentially react with the selenium.

So the first thing that you need to reduce selenate to elemental selenium is you need what's called green rust. And it's a complex iron that's formed in this steady state conditions with water and oxygen. So green rust in iron will reduce selenate to elemental selenium.

In the process of the oxidation of iron, you also produce ferric iron, which is Fe +2, and ferrous iron, which is -- or ferric iron is Fe +3 -- excuse me -- and ferrous iron, which is Fe +2; and ferric iron at the right pH will reduce selenate to selenite. Or, excuse me. Ferrous iron at the right pH will reduce selenate to selenite. And then ferrous iron at the right pH will reduce or adsorb the selenium, the selenite.

So when you have zero valent iron, those three things are what's going on, and you have to control the pH to keep -- so what you would do is stage that so that you can maintain a lower pH to get your green rust. And if you're successful in doing that, then it's possible to reduce all the selenate to elemental selenium.

In the event you can't keep the pH that low, because what happens is you actually produce hydrogen ions -- really, zero valent iron was used, first, to try to understand how you could make hydrogen. And so what happens is immediately when

you expose it to water, you actually raise the pH. So you have to control the pH low to keep green rust. And then if you -- you know, whatever iron is left, you still have the potential to remove selenite and selenate through either an adsorption or reduction process.

So those are the things that go on, and you can engineer around that to make those reactions happen as you want them to in the water environment.

Q. Okay. How does -- let me switch over to -- you talked briefly about RO, the membrane technologies. How do they work?

A. Well, there's an array of membranes with different what they call cutoff sizes for sizes of molecules. And you could actually go up to a nano filter to remove selenate, but what happens there is you pick a membrane that lets certain things pass through it or not based on its size. And in the case of RO, typically it will remove all the ions. So you end up in the permeate having water that's void of any ions generally.

Now, if you pick a bigger, wider RO membrane, then that will let more things go through. Ultimately you can go to nano membranes, and that will, you know, let even more things through. So basically you pump water through above the osmotic pressure and you separate ions from water and you create a permeate and a reject. And the reject is where you're -- the things you don't want are. And then you have to

manage the reject in a reverse osmosis system.

So in the case of selenium, you know, most membranes will give you 75 to 90 percent recovery. On 100 gallons per minute, you may have to manage 25 gallons per minute of reject. So that's why reverse osmosis doesn't necessarily completely solve the selenium removal problem, because you still have a big flow of reject that you have to manage that still has selenium in it, so --

Q. Do you also have to manage the permeate?

A. You do. And you typically have to blend that because if you pick a real high cutoff membrane, you create this water that's devoid of ions, and you need what's known as an isotonic solution to support, you know, aquatic life, aquatic freshwater life. So what we would normally do is blend some of the water and reconstitute it before you put it in the stream.

Q. Now, if you put the water straight in the stream, it would be -- it would kill the fish?

A. It could, yes.

Q. All right. Let me switch and ask you to talk about biologic systems. And we've talked -- we've talked about ABMet and we've talked about fluidized bed reactors.

In general, how do biologic systems work?

A. Well, the -- what the concept here is that we are -- we are taking what's known as a heterotrophic population of

microbes that will grow and reproduce in the absence of oxygen by obtaining their energy from carbon, which would be known as the electron donor. And so what they need is an electron acceptor because oxygen is normally used in an aerobic environment for heterotrophic bugs to grow and reproduce.

So, you know, the classic example would be denitrification or nitrate in municipal wastewater is -- is really what you're doing is you're adding a carbon source in the absence of oxygen where the bugs then will use the nitrate to remove it. But what's really different here with selenium is in the case of nitrate, you actually create nitrogen gas. So that's generally purged out of the water.

With selenium, if you go through this same process, selenium exists as selenate and selenite. Those are oxyanions, just like nitrate, and they act as the terminal electron acceptor. And what happens in this case is the selenium actually gets reduced, so it's still in the environment as reduced selenium, and so we've done the job of reducing the selenate and selenite. So we have to carefully manage the biology because they form these nano particles that are reduced selenium. We don't want to reaerate those and reoxidize those.

So that's what's so unique about applying the ABMet and the FBR process in this application. FBR has been used for nitrate removal and for chlorate removal but never in

selenium -- never for selenium. ABMet really is just a variant on an anaerobic filter that's been used for years. Some people know it as a trickling filter. It's a downflow filter, but it was really produced by a company of microbiologists that recognized how unique and complicated it was to biologically remove selenium.

Q. That's it. Did you in your role as a technical person on this project -- first of all, did you participate or review the VSEP pilot that was performed?

A. Yes, I participated; and, yes, I reviewed.

Q. Okay. What was the -- what was the conclusion of CH -- well, let me -- what was -- what was CH2M Hill's conclusion as to whether VSEP was a viable technology for use in this environment?

A. As -- as prescribed by VSEP, their technology wouldn't work based on their pilot tests.

Q. Okay.

A. But -- but we felt that it's a variant of a reverse osmosis technology. There's other variants of RO, and -- and so there's a whole dog's breakfast or mix of RO technologies. We felt that it could be engineered much like more of a conventional RO to work, but in the pilot testing, what happened was they ended up having membrane fouling issues that compromised their ability to maintain the flux, the amount of water that you push through the membrane to keep the permeate

that you need. And then over time what was happening is they were bleeding selenium, because there was so much scale on the membranes, that the membranes were fouling irreversibly. And so if you would have put in their system as they prescribed, in a month's time you would have violated the selenium limit in the permeate.

Q. In your January 26, 2009 treatment alternative evaluation, which is Exhibit 5, am I correct that you recommended the piloting of an FBR system?

A. I believe we did.

Q. Okay.

A. Yes, we did --

Q. Okay.

A. -- on page 3.

Q. All right. And did CH2M Hill actually perform a pilot of an FBR system?

A. Yes, we did.

Q. Did you participate in that pilot?

A. Yes.

Q. Did you participate in the review of the efficacy of FBR as shown by that pilot?

A. Yes.

Q. What was the -- what was the conclusion of CH2M Hill as to FBR as a viable technology to employ in the treatment of water at the outfalls at Apogee Mine?

A. As a core selenium removal process, we felt that it would meet the 4.7 microgram per liter with the right post treatment of the biological solids.
Q. Okay. You did not pilot -- your pilot was -- Patriot didn't have you continue the pilot on the biological solids?
A. Right. We focused mainly on, is that technology capable of meeting a 4.7 microgram-per-liter limit on --
Q. On any of the other pilots, did any of the other pilots focus on handling the permeate and the waste, or did they all just focus on whether or not you could achieve permit compliance?
A. They all focused on permit compliance with the exception of the VSEP work where we looked at on paper how would you manage the reject, but we didn't do any pilot testing to validate or verify those concepts.
Q. Okay. So is it fair to say, then, in terms of pilots of RO and ABMet -- and those were done by GE?
A. Yes.
Q. Okay. And did you review both of those --
A. No --
Q. -- at sometime?
A. -- not in detail.
Q. Okay. I just wondered if in your final -- it's my understanding the recommendation at this time from CH2M Hill to Patriot is a fluidized bed reactor.

A. Yes.
Q. Okay. Did you -- in terms of picking that over RO, did you look at all at the GE RO pilot?
A. No, other than one of our other technologists who did look at it said that it fouled; they had fouling issues.
Q. How about -- how did you pick FBR over ABMet?
A. We picked that based on footprint and then some of the pretreatment issues that you would have with the ABMet process. So it has the least complex system to manage selenium, meaning that the ABMet, it again acts as a filter, so we have a potential for suspended solids that could filter out in the ABMet process. And what that means, then, in order to maintain the mass transfer in the reactor, you would have to periodically backwash the ABMet systems, which is what they do in the power industry. So you need big tanks to backwash these filters.

They also have gassing issues. So you have to de-gas the beds periodically, which disrupts the continuous treatment. There's -- you know, instead of continually sloughing the microbes, periodically you have to backwash the beds to purposefully slough the microbes off. So what all this means, bigger footprint, more complexity, and more challenges to operate.
Q. Some of the testimony has been that FBR is less expensive than ABMet. Why is that?

A. It's in part because of the reactor efficiency more than anything. The mass transfer is greater with the fluidized bed reactor than it is a static bed, trickling filter, or, in this case, ABMet. They have a static bed carbon that supports the bio growth, so you get better mass transfer, and that means a smaller footprint and a more efficient process.

Q. Is it fair to say that after review of chemical, membrane, and biologic systems, that CH2M Hill centered on FBR as being the most appropriate application for this environment?

A. Yes.

Q. And there's been testimony yesterday and today suggesting that Patriot has contacted CH2M Hill and asked them to move forward with the next step of providing some cost estimates and preliminary design as it relates to constructing a fluidized bed reactor at the three outfalls at Apogee. Is that your understanding?

A. Yes.

Q. And is that work in process?

A. Yes.

Q. I'd like to hand you now Exhibit Number 4 and ask you what that is.

A. This report is titled Preliminary Watershed Flow Estimation with Diversion and Equalization Analysis-Patriot Coal, Apogee Site, Ruffner Mine for Outfalls 001, 002, and

003.
Q. Okay. This is another report on January 26, 2009. I believe there were three reports issued in that -- either that day or that week?
A. Yes.
Q. Okay. What is -- what is the -- could you describe generally what this report is telling us or what this report was telling Patriot Coal?
A. Yes. This report was establishing what would be the base flow out of each of these outfalls and then looking at the potential water flows at defined rain events. You know, we needed a flow number for basis of sizing and design.
Q. Can you look at page -- the second page of the report. I just want to -- we've had -- we've been discussing flow all week, I think.
A. Yes.
Q. And I just want to understand what some of these terms mean, and I don't know that we've asked anybody that. Let's use Outfall Number 1 as our example in page Table E-1, all right?
A. Yes.
Q. And am I correct that Outfall 1 is Slab Fork, which is the largest of the Apogee outlets?
A. Yes.
Q. Okay. It says here that annual average base flow is

750 gallons per minute.
A. Yes.
Q. Okay. What does that mean?
A. That was the annual average flow reported at the discharge monitoring location or the weir that they measured flow at or the control device in 2008 with the data that we had to do this study. So that would include, you know -- you know, wet and dry weather events.
Q. Did you review -- do you know who performed the analysis to come up with these numbers? Do you have folks at CH2M Hill who did that?
A. We did. We assigned what we would call some water resource engineers, who are subject-matter experts in the understanding of water flow in watersheds.
Q. Okay. Now, the number next to that is 1600 gallons per minute, and it is in a column that says Design Average Flow. Would you explain that number?
A. The water resource engineers when they looked at the rain events that had happened from the period of 2006 through 2008 recognized that 2007 was an abnormally dry year. So they felt that that would influence the rain -- the base flow that they were looking at in 2008, even though in 2008 the rainfall was close to the average, which is somewhere around 46 inches. So in the Charleston area, Logan area, it's between 43 and 46 inches is what we would call an average rain event.

So what they wanted to do was establish a safety factor to the base flow that had been recorded at these outfalls. And so, you know, the 1600 would represent the annual average flow of, say, 45 or 46 inches over each of those watersheds, in this case 001, added to the flows. So it's a conservative estimate of what the flows would be to compensate for the concern about the previous year of dry weather.

Q. Okay. And in shorthand, would that be the base flow plus the average rainfall?

A. Yes.

Q. Is that a fair characterization?

A. Yes.

Q. Okay. Now, you have columns for 1-, 10-, 25-, and 100-year storms. Where does that information come from?

A. These storm events are -- they are -- they're put together by the U. S. Geological Survey, and they are estimates of rain events in this geography. And so we took a standard, you know, pulled information from the USGS out on a 1-year, 10-year, 25-year, and 100-year storm, and they're estimates of how much rain you could get. The worst case rain event in 24 hours in one year would be what we would call a 1-year storm.

Q. Table E-3 on page 3 --

A. Yes.

Q. -- talks about the need for additional volume in the

event of a 25-year, 24-hour storm, and you used the term first flush. What does first flush mean as it relates to a storm event?

A. Well, there's a -- if you go to page 26, there's a curve that shows this storm hydrograph, so if you wanted to see that, but basically what happens is when it rains in a watershed at times zero, it takes a while for the rain to actually manifest itself in the discharge. And so over a period of time, it eventually does happen. And then it not only begins to increase, but then it spikes, and the spike generally is what the storm water engineers would call the first flush.

Q. Okay. Does Table E-2 -- I'm trying to understand. I look at a 25-year storm. It's 438,500 gallons per minute, which seems to me to be a whopping amount of water. Is there someplace that translates that into gallons per minute?

A. Say your question again.

Q. Or that is gallons per minute. Okay. I'm sorry.

A. What -- what -- okay.

Q. You can tell my confusion. So in a 25-year storm, you're talking about 438,500 gallons per minute. And that's an estimated calculation?

A. Yes, that would be the -- yeah, that would be the estimate based off of a storm hydrograph.

Q. Okay. Now, look at page 10.

A. Okay.
Q. There is a graph on page 10.
A. Yes.
Q. Can you tell me, what is this graph and what does it tell us?
A. This is really an EPA -- well, if you go to -- it's really the USEPA's basins -- comes from the USEPA basins program, which really is a hydrograph that -- where they monitor the rainfall exceedances so they keep track of the rain over time.
So this represents 26 years of rain collection data in this area that the EPA would, you know, describe to use to try to predict how much rainwater to treat.
Q. Would rainfall for Charleston be applicable to the area of these mines?
A. Yes.
Q. Okay. Help me understand this curve. And let me -- if it would be helpful, if you want to step over, and I've got some writing I want to show. What does it mean? I mean explain how this curve works and what it means in terms of historical rainfall.
A. Okay. Let's see here. So I guess the best way to explain it --
Q. Can you just go around to the other side so the judge can see you?

A. Oh, yeah, sure. Sorry.
Q. He's got a bad shoulder.
A. If you go to page 9, you know, the 1-year, 24-hour rain event is 2.2 inches, okay? So as an example, in this -- in 26 years, if you go over to this graph, this is 1, 2. So this is 2.2 inches. So in 26 years there was less than five-tenths of a percent chance that they had a 1-year rain event. (Indicating)
Q. You make reference in the report to 10- and 25- -- 10- and 25-year storms. Based on historical data, have we had any of those storms in Charleston?
A. In 26 years -- in 26 years they have never had a 10-year rain event, because this is basically 3.4 inches. And a 3.63-inch rain represents a theoretical 10-year rain event. And that's on, I guess, page 9. We have the rainfall depth.
Q. So looking at page 3 of your report --
A. Uh-huh.
Q. -- and based on this data, if you designed the system to your design average flow at Outfall 001 --
A. Yes.
Q. -- what percentage of water would you capture based on historical data?
A. With modifications to the lagoon so that we could control, you know -- because if we have, I think, on the -- we have on -- let's say for Outfall 001 we actually have

available 41 acre feet, we could -- if you design this for 750 gallons per minute and then we build volume into the pond, then we would control all the flows through a theoretical 10-year storm event, which we said didn't happen on the 26 years.

Q. So would you catch all the water -- how -- what percent of the time?

A. We would treat all the water.

Q. Okay. What if you designed it --

A. But that's as long as you can vary the volume in the impoundment, the three impoundments already there.

Q. So, in other words, when you talk about a 25-year storm and having a 60-foot dam and all, if you look at historical data, do you think you could design this with modifications to existing ponds?

A. For a 25-year storm event?

Q. No, no, no. I'm saying -- bad question. You talked about needing a 60-foot dam at Outfall 001 for a 25-year storm event.

A. Yes.

Q. But if history proves -- based on the historical data, if you designed it at 750 gallons per minute, how much water would you capture based on historical data if you could modify the ponds?

A. We would capture all the water in that 26-year rain.

Q. What if you -- what if you went to your design average

flow? First of all --
A. We would capture more water than we would theoretically need. You know, again, that's the conservatism that our storm water guys put in the number.
Q. So at some level, if there's a 25-year storm, you have runover of a system, correct?
A. Yeah. I mean we arbitrarily talk about a 25-year rain event because, you know, typically for most urban watersheds or industrial watersheds, they're typically -- you typically want to handle the first 20 -- 10 to 20 percent of the rain event. And I guess if it's defined in here, I'll tell you what -- it's explained why we picked -- why that's a starting point to look at. But it's not the end-all.
What we would try to do is see if that's representative of what actually happens and then work with the regulators to permit, you know, what makes sense given the real data, so --
Q. And you've come to these conclusions based on the data that we've described. Will the rainwater study further refine that data?
A. No. It will verify the response curve to help calibrate the mile. So it will tell you, you know -- it will give us a better understanding of how much -- what runoff coefficients to use and how quick the water comes out, but it's still the same footprint. The study was really looking at the potential for the dilution effect on the selenium as a function of the

rain event.
Q. A couple of questions. I think Dr. Koon testified yesterday that -- and I think essentially that looking at 25-year -- or first flush of 25-year storms is not applicable in anything other than an urban setting. Do you agree with that?
A. It's not applicable?
Q. Correct. It wouldn't be an applicable in this setting.
A. To look at a 25-year rain event?
Q. To look at capturing the first flush. Just doesn't apply.
A. Repeat the question again. I'm --
Q. I'll move on. I'll withdraw that. One question. I want to be clear. The 750 gallon per minute, I thought that that came from DMRs and historical data. Is that -- is that -- was that measured or was that DMRs and historical data?
A. It was measured and put into discharge monitoring reports, as I understand it.
MR. HURNEY: Okay. Your Honor, I have no further questions.
THE COURT: All right. Mr. Lovett?

CROSS EXAMINATION

BY MR. LOVETT:
Q. Hello again, Mr. Sandy. How are you?
A. Good. How are you?

Q. Let's work backwards here. You should have before you I guess the preliminary watershed flow estimation that CH2M Hill prepared?
A. Sure.
Q. Let's start with this curve --
A. Okay.
Q. -- on page 10. I notice that's from 1970 to 1996; is that right?
A. That is correct.
Q. What's happened since 1996?
A. I don't know.
Q. Was there a flood in West Virginia in 2008?
A. I don't know.
Q. 2001 I mean.
A. I don't know.
Q. I mean why would CH2M Hill have put a curve in here that stopped in 1996?
A. I don't know exactly. I mean an analogy would be, you know, I do -- we do air permitting, and generally the regulatory authority have canned sets of meteorological data that they would accept, that they validated the data and verified. So I'm being presumptuous here, but likely EPA hasn't verified and validated the data since that period, which, you know -- and we wouldn't want to use a dataset that we couldn't get EPA or the DEP to buy into, so --

Q. But you don't know if EPA has verified new data.
A. I don't. Our storm water water resources people would know.
Q. And they're not here to testify, are they?
A. They are not.
Q. And as I understand the definition of a 25-year storm, it doesn't mean it occurs once every 25 years, does it?
A. It's an arbitrary event, and that is the intent based on a bunch of statistics and Monte Carlo simulations, but they're all more or less an estimate of some kind of a rain event, and they just try to put them in categories based on these simulations.
Q. It happens, doesn't it, that you have two 25-year storms within 10 or 15 years of each other?
A. It could.
Q. And it does, right?
A. It didn't in this dataset --
Q. I understand it happens all the time all over the world.
A. I don't know if it does all over the world. I don't know, but it is a possibility. It's probable.
Q. And it's just as likely that you wouldn't have a 25-year rain event in a 25- or 26-year period, right?
A. Yeah, yeah. This is probability and statistics, so --
Q. So when permitters design permits, they don't -- they base it on what the estimate -- just as your waste -- just as

your study does, bases it on the 25-year storm event numbers, the 10-year storm event numbers, and so forth, right?

A. Yeah, they would, but, you know, if you showed them this curve and we went through this analysis and said, well, we haven't had a 25-year rain event, you know, the probability is low, and, you know, we can handle these more probable rain events and treat 99.95 percent of the flow, we've been able to permit facilities to do that.

Q. Does the fact that you haven't had a 25-year rain event in 25 years mean that it's less likely you're going to have a 25-year rain event next year?

A. Could you repeat --

Q. Would the fact that you have not had a 25-year rain event in the last 25 years make it likely that you're not going to have one next year?

A. I don't know. You're sort of getting out of my bailiwick.

Q. The only reason I'm asking is because you testified about this or I wouldn't have asked you about it.

A. Testified about --

Q. The curve here and the meaning of it.

A. Oh, okay. You know, if you look at that data, you know, I can speak to the data there, and it basically shows that there wasn't a rain event in that magnitude, so --

Q. If you were told that there was a 100-year flood with

8 inches of rain on July 1, 2001 in the Guyandotte watershed, would that change your estimation, your testimony relating to this curve and its usefulness for this case?

A. A 100-year flood?

Q. Yeah.

A. An 8-inch rain? I'm not familiar enough with the watershed to know how Rum Creek impacts the Guyandotte, so I really wouldn't know. I mean, you know, if the rain is flashy -- and we say that in the report, so you can have a really concentrated rain event happen in one part of the watershed and not the other and that may have been what contributed to the flood, but, again, I'm speculating, because I don't know the details.

Q. Okay. Let's look at the tables on pages 2 and 3 of the report.

A. Exhibit 4; is that right?

Q. Yes.

A. Okay.

Q. Now, I think you just said it was Rum Creek, but it's not Rum Creek, is it? It's the Mud River watershed, right?

A. I think, yeah, ultimately Rum Creek goes into Mud River, yes.

Q. Now, as I understand it, your -- what department -- I can't remember the name of the department that you said performed this study.

A. It's our water resource engineers.
Q. Water resource engineers. Your water resource engineers concluded that a 25-year storm would produce 438,500 gallons per minute, right?
A. Yes.
Q. And I think that if you follow that down to the next -- does that work out to be equalized -- if you equalize that flow, what would you have to treat over the year? Do you know?
A. Well, if you go to Table E-2, the -- can I pull my calculator out?
Q. Yeah.
A. I can better explain, I think.
Q. Is it E-4 that tells us, or am I mistaken?
A. Well, let me clarify. E-1 really is the peak instantaneous flow.
Q. Okay. I see.
A. So if you go to that curve with the spike in it --
Q. Right.
A. -- that 438,500 gallons per minute, that would be the flow rate right when the thing peaks out, okay?
Q. It's a higher --
A. Well, it's the highest instantaneous flow rate during the twenty -- as the water runs off.
Q. Okay.

A. So in E-2, the -- to your 25-year storm event, we estimate that the total runoff, if we collected every drop, based on the modeling and the assumptions about what happens in the water, would be 54.1 million gallons.
Q. Okay.
A. Okay. And then if you go to table E-4, which I think is where you were trying to go --
Q. You're right.
A. -- is we've said, okay, what did CH2M Hill say if we were going to put in an impoundment to handle the first flush, which we feel, you know, of any rain event, that's generally where we would design a system. So in this case we looked at a 25-year rain event and said, okay, what would the first flush require, and we would predict we need about 30 million gallons. And then the design maximum flow of 4000 is based off of, okay, what would we have to pump that water out of that tank or out of this impoundment so that we could make room for another rain event.

So the estimate is in six and a half days to move 30 million gallons, we would have to make provisions for 4000 gallons per minute. So that's what those numbers mean, as I understand it.
Q. So at all three outfalls for that first flush --
A. Uh-huh.
Q. -- you have 5150 gallons per minute, right, if you add

the three up on E-4, Table E-4?
A. Oh, if you took 4000, let me just -- I'm not real good with numbers off my head. So theoretically if, you know, we felt that that was what needed to be designed for, that those would add up to that volume.
Q. And as I recall from your deposition, you think that treating for the first flush of a 25-year storm is the kind of thing that regulators require fairly regularly across the country.
A. Well, there's in some cases precedent set around that, but it's generally a starting point to look at what seems reasonable given the statistics about these rain events. And so as an example, like in Ohio, they would probably -- you know, they've let mining companies get by with a 1- or a 10-year rain event.
Q. For a water quality based effluent limit?
A. Yes, yes, as I understand it.
Q. How do you understand it? Have you been involved in a project in Ohio where --
A. No, I have not, but based on our discussions last week, we went back and, you know, trying to better understand this, we tore into where has precedent been set. So it varies anywhere in any state based on, you know, a lot of different considerations. So I don't think there's a set rule.
Q. Well, as I understand, the rule is the operator has to

treat all of its effluent to the water quality standard, right?
A. Yes, as I understand in NPDES permitting.
Q. And the only way to be able to bypass any flow from a water quality based effluent limitation outfall is to say that during that rain event, the water will contain selenium, in this case, below 4.7 parts per billion; is that right?
A. That is correct.
Q. That would be true of a 100-year event, wouldn't it?
A. Yes.
Q. So in order to convince the DEP to reduce the amount of flow that would have to be treated, the operator would have to show DEP at those rain events the water would not be in violation of the permit.
A. Yes. That's why we were doing the storm water study, to look at the dilution effects --
Q. Right.
A. -- of the different watersheds, so --
Q. So based on the fact we don't have that study yet, a 25-year first flush may let a lot of water through that, in fact, violates the permit, right?
A. Yes.
Q. Let me see if I've finished with this document and we can move on.
A. Okay.

Q. I just want to make sure I had.
A. Right.
Q. Well, do you know -- you know, don't you, that Jackson & Kelly had prepared for this case another estimation of flows from a Mr. Thacker? Is that right?
A. Yes, I'm aware of it. I didn't read the deposition, but I'm aware of it, yes.
Q. Have you seen the report?
A. I have not seen the report, but a colleague of ours read the report and a water resource person to explain it to us, so yes.
Q. Do you understand that it predicted much higher flows than you did?
A. Yes, but the reason it did was they looked at icing events, so they assumed that with the ground frozen and it rained, that the water would run off at a much greater rate; and when that would happen, we wouldn't expect any selenium to be in the water from the surface runoff because it's generally representative of a snow and ice event. And as I understand it, that's really used more for design of dams and not necessarily what we would use for trying to predict water quality and water treatment.
Q. Okay. I'm not going to go to the snow and ice. I think it's late in the day.
A. But that's the answer to the question based on our water

resource guys looking at it.
Q. So based on your review, your water resource guys' review of that, you still stand by your January 26 report, right?
A. Yes. These are best estimates we have, so --
Q. Okay. Let's go to the Joint 11, which is the Metals Council paper that you -- do you have one of these up there? (Indicating)
A. I'm not sure.
MR. LOVETT: May I approach?
THE COURT: You may.
BY MR. LOVETT:
Q. Were you involved in the preparation of this report?
A. Yes.
Q. When was it submitted?
A. June 2010.
Q. And the North American Metals Council is a trade group; is that right?
A. Yes.
Q. Who else helped you prepare this?
A. Our project manager was Cindy DiSante.
Q. Uh-huh.
A. And then we had subject-matter experts like Tom Higgins, Harmony Rathnum (phonetic), Jamal Chamas (phonetic). They're listed, I think, here in the credits.
Q. That's fine. Are they all from CH2M Hill?

A. They are, yes.
Q. Okay. I just want to look at some of these technologies quickly.
A. Sure.
Q. Let's turn to page VIII. There are charts --
A. Over in the big table in the executive summary?
Q. Yes.
A. Okay.
Q. That's right at the front, isn't it?
A. Yes.
Q. Okay. So I want to just talk about the technology that you and Mr. Hurney talked about. The first one is ABMet, right?
A. Yes.
Q. And the column with the Development Stage for Selenium Removal, you say -- have you found the page? I'm sorry.
A. Did you say VIII?
Q. Yes. Am I wrong? It says Table ES-1, Technology Summary. It has ABMet as the first one.
A. It's the very first one, that's right. We put them in alphabetically. All right. Yeah, I'm sorry.
Q. Do you see it?
A. Yeah. Sorry.
Q. And there you say ABMet is development stage at full-scale for selenium removal, right?

A. Yes.
Q. And that's what the GE pilot showed, too, isn't it?
A. Yes. This is full-scale, though, as it applies really mainly in the power industry, because that's where their big systems are at, so --
Q. It's used in the power industry full-scale, right?
A. Right.
Q. Has not yet been used at coal mining full-scale.
A. Yes, that's correct.
Q. But it's been shown to remove below 5 parts per billion on a consistent basis, hasn't it?
A. Yes, that's correct.
Q. And the pilot here showed that, didn't it?
A. Yes.
Q. Do you know what levels it can get selenium to?
A. No, I don't.
Q. Okay. Would it be reasonable to think it could get to a non-detect level?
A. Yes, potentially with, you know, with -- you know, we'd have to add a lot of, you know, carbon, but it's a potential. It's possible.
Q. And if the -- you know, we had testimony from a biological expert in the case that the standard could go to as low as 2.6 parts per billion in the future.
A. Uh-huh.

Q. If it went to 2.6 parts per billion, I guess the ABMet could be modified to handle that; is that right?
A. Yes. It would be more of a -- you'd have to add more chemicals, but yes, that would be the way you would get to lower levels. And you may have to operate it at longer HRTC, may have to add more ABMet reactors.
Q. Could the FBR get there too?
A. Yes, with similar modifications.
Q. Okay. And RO as well, I guess.
A. Yes.
Q. All right. Now, I'll flip over to page XV, the fluidized bed reactor summary.
A. Okay. Sure.
Q. Do you see that?
A. Yes, I'm there.
Q. And you have Development Stage for Selenium Removal, Pilot, right?
A. Yes.
Q. And that was before the pilot study here was completed --
A. Yes.
Q. -- is that right? Would you leave that in the same category now or would you change it?
A. Well, theoretically until we have a full-scale system in, we'd leave it pilot, but yeah, you know, so --
Q. But you know it's going to work now, right?

A. Yes.
Q. So it would be reasonable to --
A. For 4.7 it will work.
Q. For 4.7?
A. Yes, with the right post treatment.
Q. I understand. So it's a little bit -- it's really beyond pilot-scale at this point. It's ready to go, right?
A. Yes.
Q. And as I understand it, you said that these technologies were fledgling because they hadn't been used yet in the coal industry, right?
A. Well, I would say all industries, because they haven't been used for selenium reduction. I mean ABMet was developed for selenium reduction, but I was referring to just the concept of attached growth biological treatment.
Q. Okay. But ABMet I thought -- you say it's ready for full-scale. It's used full-scale. It's certainly beyond the fledgling stage now, except that it hasn't yet been applied to coal mining, right?
A. Right, yes.
Q. And the FBR, though it's never been used on a full-scale system for selenium, has been used in a full-scale system for a lot of other pollutants, right?
A. Right, but they're different pollutants. That's not a fair extrapolation.

Q. I didn't mean -- but one of the pollutants you testified in your deposition -- I can't remember which one --
A. Perchlorate.
Q. Yeah, okay. So that's very similar to selenium, right?
A. It's similar, but it's not, because what happens when perchlorates reduce, it forms chloride, which is soluble. So you don't have to worry about whether it gets reoxidized or capturing it.
Q. I understand, but you can --
A. It's not harmful at that point, but selenium is.
Q. But you can handle the reoxidation of selenium without any problem in an FBR system, right?
A. Well, as we discussed in the deposition, we need to verify and do some more pilot testing around that.
Q. Not -- but pilot testing isn't to tell you whether you can do it. It's to decide which of one or two methods to adopt.
A. Right, how we would keep it from being --
Q. Right. So you don't have any doubt about that.
A. Right, but we're still developing technology.
Q. Okay. Let's move to RO. That's on page XVIII. I have to think back to --
A. Uh-huh.
Q. -- high school. It's 18.
A. Right.

Q. Reverse osmosis you say there, developmental stage for selenium removal at full-scale.
A. Right.
Q. And I understand that it's probably too expensive to use, if ABMet and FBR were as well, but reverse osmosis is a full-scale proven selenium-removal technology, right?
A. Right. In this case I believe it was a 100-gallon-per-minute system. It's not, you know -- but, yeah, there's a full-scale system that's not without scale issues and operating issues and whatnot, but there is a system out there.
Q. But those are pretreatment issues that can be adjusted and taken care of, right?
A. Yes.
Q. You have no reason to doubt that with enough money, one could design an RO system that would remove selenium from --
A. Yes.
Q. -- 3000 gallons per minute, right?
A. Yes.
Q. Okay. Now, let's go to XX, or 20, and look at the ZVI.
A. Okay.
Q. You have ZVI listed as pilot-scale, right?
A. Yes.
Q. Now, the difference -- so we had ABMet at full-scale, we had RO full-scale, we had FBR pilot, but it's moved up in the world since then it sounds like and is close to getting its

license to be a full-scale --
A. Yes.
Q. -- pilot. I mean a full-scale technology.
A. Yes.
Q. And then for disadvantages for ZVI, I notice you list several. You say it has not been proven full-scale treatment -- in full-scale treatment and at higher selenium concentrations.
Are these higher selenium concentrations that we're finding at the Apogee Mine?
A. No, I think this is really more in reference to what you might have in the power industry, meaning that in the power industry, you could actually have as much as parts per million. So you go out of the parts per billion level, so you can get up into really higher concentrations, so -- and no one has really tried that technology where you've had milligrams per liter, which would be parts per million, versus micrograms per liter, which would be parts per billion, so --
Q. You're talking about higher --
A. Yeah, I'm talking about high, high; yeah.
Q. Okay. Now, ZVI, though, has other disadvantages associated with it there I see.
A. Yes.
Q. I know you haven't been involved in the MATRIC and Liberty pilots --

A. Uh-huh.
Q. -- or MATRIC and ShipShaper pilots, but are you aware of any data that show that they can consistently reduce selenium below 5 parts per billion?
A. I really haven't seen any of the data. No, I understand from some conversations, you know, with John McHale that the systems are treating down -- Titanic now to below 4.7, but I haven't seen the data to support that.
Q. And I think Mr. McHale said it's not consistently; is that right? Is that your understanding of what --
A. Well, he said the last couple of months he thought that, you know -- but I haven't seen the data. I mean he said in the last few months he's had good results, so --
Q. That's all he said, good results? You don't have the data?
A. Well, I'm assuming. I'm presuming, yeah.
Q. And then you said I think in -- I think Mr. Harrison also said there was a mine treatment, some -- is that a phosphate mine?
A. Yeah, that's a small-flow phosphate mine in Idaho.
Q. And is that what's referenced on page 4-47 here?
A. In this big document?
Q. Huh?
A. In this big document?
Q. Yeah, in the big -- the one that you wrote, your 4-47,

the Metals Conference document.
A. Oh, the Society of Metallurgical Mine Engineers?
Q. No. I'm sorry. Maybe I'm -- yeah, the North American --
A. North American Metals Council, okay.
Q. The one you were just looking at. It's the same document. 4-47. It's about a third of the way through the document.
A. Yeah.
Q. Do you see that?
A. No, these are different, Joe. The Golder Study, that's actually a -- that's a different study.
Q. Okay. Well, that study in any event shows that effluent concentrations of selenium were not consistently below the regulatory limit of 5 milligrams per liter -- or micrograms per liter for this pilot system.
A. Yes. It said it varied from 5 to 14, but that's not the Monsanto Study that -- so --
Q. So it didn't work, did it?
A. Well, in this case the pilot test they did said that the selenium varied from 5 to 14, and I'm not familiar with all the details of whether it was configured as a passive system or how they tried to control the environment to make that work. But, yeah, if 5 is the metric, then at times they must have been over 5.
Q. Okay. And you didn't put any -- you don't have any story

of success in this June document, do you, for ZVI getting to below 5 parts per billion?

Did I say ZVI? That's what I meant to say.

A. I mean if -- I'd have to -- I'd be speculating, but if you -- I mean I don't know exactly. I'd have to go back and read or talk to the people that put the case studies together, but, you know, based on this one page, this implies that the concentrations, you know, range from 5 to 14 in one study, 12 to 22 in another --

Q. We have testimony from a lot of witnesses, but I haven't seen a single piece of paper that shows me the result from a ZVI study showing consistent reduction below 5 parts per billion. Do you know where I could find that?

A. No.

Q. So you think you can design, build, and commission an FBR system within about two and a half years, right?

A. With the schedule contingency.

Q. Do you think that it would be -- that you could design and build, commission a ZVI system within two and a half years that would meet the water quality limit at all the Apogee outfalls?

A. No, not without pilot testing.

Q. A lot more -- a lot of engineering too, right?

A. Development work, yes.

Q. Really, in terms of fledgling, the playing field isn't

like there are fledglings and non-fledglings. There are levels and degrees within what you're calling fledgling technology, right?

A. Yeah, I mean there's levels of -- but, you know, in the case of Titanic where they have these systems, which we haven't looked at, they're small enough flows, you know, there may be a way to -- there may be a simple remedy, but we haven't been asked to look at it, so --

Q. You don't have any idea, right?

A. I don't.

THE COURT: Well, to be clear about it, you've actually proposed the Titanic flow be delivered to a centralized fluidized bed reactor treatment facility to be constructed at Slab Fork.

THE WITNESS: Yes, sir. Yes.

THE COURT: While I'm on that, I want to clarify something as well. I understood Mr. McHale to say that I guess in this last few weeks when your company made this report and recommended FBR at the facility, that you provided him some sort of an estimate -- maybe it was one of these Class 5 estimates -- of somewhere around $40 million for a centralized system?

THE WITNESS: Yes.

THE COURT: Did I understand that right?

THE WITNESS: Yes.

THE COURT: And then if you went with individualized systems at these three outfalls, the cost would be higher, around 46 million.

THE WITNESS: Yes, sir.

THE COURT: And those are Class 5 estimates?

THE WITNESS: Yes, they're -- they're -- yes.

THE COURT: Well, then, let me ask you this, then. In several of these evaluation reports that you've got charts that compare the expected capital cost for all of these different treatment alternatives, it seemed to me that routinely the FBR treatment capital cost estimate was much lower than that at a particular -- I think those were at individual outfalls, but yet this amount for a centralized or for three individualized FBR facilities now is much higher.

Do you know what I'm talking about?

THE WITNESS: Yeah, I do. The -- first of all, the estimates that we did in the FBR report were for different flows. So that's probably what creates -- so you couldn't add those and get to the two thousand --

THE COURT: What flow, what flow capacity are you expecting to be able to treat with the centralized facility that you --

THE WITNESS: The 40 million estimate was based off of the, I think, 2200 gallons per minute, which would be in the storm water document, what we call the design.

THE COURT: Design flow for all three?
THE WITNESS: Yes, sir.
THE COURT: Thank you. That's what I thought.
THE WITNESS: And the reason -- the reason that there was some escalation is when -- when we spent last week working on the schedule and better understood where we were going to put that and knew more about, okay, this is how we'd really begin to do it, we actually went and added -- we changed the factors in the estimates to account for, you know, some of the complexities of having to move rock and those kinds of things. So that actually added to the cost --
THE COURT: Sure.
THE WITNESS: -- compared to what -- and then we included in there conveyance systems, you know, pumping and piping. So we had to make some assumptions, and so, you know, we did those very quickly, but, you know, as we learned more, we changed the cost estimates to reflect what we know.
THE COURT: All right. Thank you.
BY MR. LOVETT:
Q. I think you said at page 97 of your deposition that FBR is the appropriate technology to treat Apogee's outfalls. That's your opinion, right?
A. Yes.
Q. I want to go -- I was going to go to the question the judge asked you about the $40 million system.

A. Uh-huh.
Q. Let me follow up.
A. Sure.
Q. I think you've answered most of those questions. As I understand it, you have preliminarily estimated the cost of $40 million to treat 2100 gallons per minute?
A. Yeah, whatever the additive of the sixteen hundred and --
Q. Sixteen, four, and one.
A. Rough numbers, twenty-one, twenty-two hundred.
Q. And that's the average flow, right?
A. That would be the design flow. That's our -- with our safety factor in it. So that's a higher flow.
Q. And you weren't here for Dr. Koon's testimony, but he testified that he thought, I believe, that based on your calculations, that if you had to treat 5150 there, that would cost approximately $60 million total installed cost.
Does that sound reasonable to you, in the ballpark?
A. I don't know how you could really extrapolate to that, because you can do some parametric estimating where you apply some factors to extrapolate, but you've got to be real careful when you get out of certain flow ranges. So I would want to sit down and, you know, look at the estimate as we did, and you would change some of the factors and we would change some of the equipment costs. So you can't just do a direct

extrapolation, and I'm not even sure if that's what he did. So anyway --

Q. That was an unfair question.

A. -- you've got to be careful on extrapolating, Joe.

Q. Sure. Okay. Now, the estimates that you're giving, the $40 million for the centralized system, that does not include equalization that may be necessary, right?

A. It includes modifications to the existing impoundments to be able to handle all these flows that we talked about in the ground, and so --

Q. And do you believe in --

THE COURT: Wait a minute. All of the flows you've talked about in the graph, give me something more specific, because we've talked about flows that you don't really anticipate that are also demonstrated in some of these graphs.

THE WITNESS: Right. If you go back and look at the -- let's say the 1-year rain event.

THE COURT: Right.

THE WITNESS: If we modified the impoundment, we would be able to treat all the 1-year rain events, and that would on that graph represent 99.95 percent of all the rain based on that historical thought.

BY MR. LOVETT:

Q. On the graph it would represent -- if that graph is up to date, but a new graph could show something different, right?

A. Yes.
Q. If 5150 or a higher number had to be treated, do you think that there is the equalization volume at Outfall 1 currently to accomplish that?
A. No. We would have to make major modifications or, you know, change the approach of where we treated this to account for the volumes that would be required.
Q. And I think that your flow report says you would need a 60-foot impoundment at Outfall 1 to do that; is that right?
A. Well, that was just theoretically we said, you know, you need a 60-foot, you know, basin wall, basically.
Q. Right.
A. And I don't know how many acres of impoundment, but you'd need a big reservoir, and without -- I'm not a geotechnical engineer or a structural engineer that knows the dam policies, but you get into at these higher impoundment sizes dam issues. And so that was the intent of putting that number in there, to say, you know, okay, given this geography, that's a pretty big impoundment, and with that goes a lot of challenges and engineering issues.
Q. Well, you'd have to get an MSHA permit, right?
A. Yes, as I understand it.
Q. And I think that's probably a main concern, isn't it?
A. That would be -- yeah, that would be one of them, beyond just the engineering and the issues with the land and, you

know, all of the -- I mean it would just -- it would all snowball. It would be complicated.
Q. Okay. How many -- and Mr. McHale testified -- you may have spoken with him about this -- that he thought he could fit two or three more impoundments perhaps above the lowest pond at Outfall 1 now, you know --
A. I know what you're talking about, yes.
Q. Have you looked into that at all?
A. We have not, no.
Q. Do you know what the potential is for equalization there without building a dam if you expanded the pond?
A. If we fixed the pond so we varied the level, we could handle up to a 10-year rain event. We would treat all the water.
Q. Without an impoundment?
A. Without an impoundment.
Q. How much water is that? What would the capacity of that system be?
A. Oh, it would be 1600 gallons per minute or less, I mean because we can store the water and still toll it off.
Q. A 10-year rain event is more than 1600 gallons, isn't it?
A. Well, a 10-year rain event requires 38 million gallons or a hundred and -- maybe I misspoke here.
Q. When you're talking about -- just so I understand, are you at Table E-1 again of Exhibit 4?

A. Yeah, let me clarify.
Q. Okay.
A. The available volume in three impoundments at Outfall 001 is 40 acre feet.
Q. Currently, right?
A. Currently.
Q. Yeah.
A. And so it could not handle a 10-year storm. I misspoke.
Q. Okay. But --
A. I was assuming --
Q. I understand, but you could add to that capacity by building ponds of less than 20 acre feet in series there and greatly increase the storage capacity without having to build a dam, right?
A. Yes, up to some level.
Q. Okay. Do you know what level?
A. No, I don't, but you could theoretically, yes.
Q. As I understand the regulatory scheme -- and I just know this from discussions I think maybe with you and others --
A. Uh-huh.
Q. -- up to 20 acre feet, typically you don't need to get an MSHA permit for that kind of a pond; is that right?
A. I don't remember the thresholds, but I --
Q. And I don't think that's an ironclad rule. I think it --
A. Okay.

Q. In your deposition you testified that you didn't know until your deposition, I guess, that there was an April 2010 deadline for compliance; is that right?
A. Yes.
Q. That's right? You didn't know?
A. I did not know.
Q. And you didn't know of any other deadlines for compliance in this or other cases.
A. No.
Q. I know they're expensive, but you could also use tanks to store the flow, couldn't you?
A. You could.
Q. And do I recall that they're about a million dollars per gallon just for the tank?
A. About a dollar per gallon, and then installed, you know, multiply by three. So in rough numbers, you know, to install a million-gallon tank, it may take $3 million, in rough numbers, yes.
MR. LOVETT: One minute, Your Honor.
BY MR. LOVETT:
Q. On the graph on page 10 of Joint 4, Exhibit 4 --
A. Okay. Page 10.
Q. It's that graph, the EPA graph.
A. You like that graph.
Q. Well, I never saw it until today. It's not been an issue

in any deposition or anything, so -- now, I think -- did you use USGS data for the rest of the report?

A. I believe that the peak -- that the hydrographs were from the USGS, I believe, but --

Q. And it's true, isn't it, that the historical basis for rainfall analysis is less accurate than using the statistically based USGS values?

A. I don't know the answer to that question, Joe.

Q. Okay.

A. Our storm water guys would, but I -- I'm sorry.

MR. LOVETT: Fair enough. I think I'm finished, Your Honor.

THE COURT: Questions from the audience.

MR. LOVETT: That's all I have. Thank you.

BY THE COURT:

Q. Let me ask you a little bit more about the flow studies. I understood your colleague, Mr. Harrison, testified recently Patriot has commissioned your company to do an evaluation of the flows in particular to determine the concentration of selenium in these storm events or higher flow amounts.

A. Yes.

Q. As I understand it, you all picked one of the outfalls at Hobet --

A. Yes.

Q. -- to do that. What is the expected duration of that

study? How long do you think that's going to take? Do you know what is planned?
A. I don't know the exact details, Judge, but I believe it was around a six-month study, and Tim would know --
Q. Okay.
A. -- because he planned the project, so --
Q. Well, I understood -- and if you can answer this, fine -- that one of the reasons, perhaps the primary reason that that's being conducted is to determine whether or not there's a fair argument for treating less than these maximum potential flows that can be expected from storm events.
A. Yes, because we want to understand the concentration of selenium in response to this -- you know, we think there's some dilutional effect with this big rain.
Q. All right.
A. So that is really the primary focus of that.
Q. And you agree that's an important factor to measure or know as you design the treatment system, because that's really what's going to tell you whether or not you can get by with treating volumes per minute that are less --
A. Right.
Q. -- than in some of these potential storm events, for example.
A. Yes. I mean we would want that data to be able to sit down with EPA or DEP and say, you know, here's the data that

shows that that really happens.
Q. We've had a fair amount of testimony about the proposed schedule and the schedule that apparently was fashioned in consultation with Dr. Koon --
A. Yes.
Q. -- that would propose about a two-and-a-half-year time period. Is this study of the flows going to be conducted in sufficient time to allow as part of the design of this treatment facility consideration of whatever the findings are from this flow study? In other words, are you going to have this flow study done in time to be able to plug that into this two-and-a-half-year time frame?
A. Yes, I understand. Yeah. And I'm not averting your question, but it's really if we get the right rain and it's so -- the duration or the success of the studies --
Q. Right.
A. And so we have gotten one rain event this past week, and they haven't completed --
Q. We might be having another one now.
A. Right. I heard that. I thought someone was mad at me in the room, but the -- so if we get the right data, we wouldn't do the study any longer than we needed to --
Q. Right.
A. -- to do that, but it may take longer if we don't have the right data.

MR. LOVETT: Your Honor, I understand from depositions and from Mr. Harrison that the study is a year-long study. Is that -- you don't know?

THE WITNESS: Yes, I thought it was six months, but if it's a year -- Tim? It's a year? Okay.

MR. LOVETT: And it started in April of 2010, so it will be finished in April of 2011.

THE REPORTER: I'm sorry. I couldn't hear that.

MR. LOVETT: It started in April of 2010, so it will be completed in April of 2011.

THE WITNESS: Okay.

THE COURT: All right. Any redirect?

REDIRECT EXAMINATION

BY MR. HURNEY:

Q. If CH2M Hill had been told in March of 2009 that they had to build a system to place Patriot in compliance no later than August -- or April 5th of 2010, regardless of what technology you selected, would you all have taken the job?

A. So we were asked March of 2009 to have something in in April of 2010 --

Q. Possible?

A. -- not knowing anything, or, you know --

Q. Based on what you knew at that time, could you have built a system that would have put them in compliance --

A. No. No.

Q. Despite the reference to a 100-year rain --
A. Yes.
Q. -- based on your review of the information contained in your report, if you built a system to base flow, would you still, based on your estimation, still treat almost all of the water, treat all the water most of the time if you built to the base level? And then the same question if you built to the design level.
A. So you're saying -- you talked about a 100-year flow --
Q. I'm trying to put aside, you know, the fact that you might have a 100-year storm. Despite that, I mean is it your estimation that if you built to either the base flow or your design flow, that that would -- with the modifications that you discussed, that that would treat all of the -- you know, virtually all the water 98 percent of the time?
A. Yes, based on the historical rain events that were -- if you go back to the graph that we've talked about, but that's -- so yes.
Q. And I mean does anybody build for a 100-year storm?
A. I have not worked on a project where I have done that, but that doesn't -- I don't, you know.
Q. Have you ever heard of it?
A. We have not done that in our business group in my 23 years that I'm aware of, so --
MR. HURNEY: I don't have any further questions.

THE COURT: All right. Anything else?

MR. LOVETT: Just one.

RECROSS EXAMINATION

BY MR. LOVETT:

Q. You haven't built for a 100-year storm?

A. Have not.

Q. Have you built for a 25-year storm?

A. We have.

Q. And the first flush of a 25-year storm is much less than a 25-year storm, right?

A. Right. We built for some that are one or no. We, you know -- I mean really it's a function of what makes sense to be in compliance with the water quality requirements.

Q. I understand this is a water quality based effluent.

A. Right.

Q. It makes a difference, right?

A. Well, it is different, but we've done -- we've had other water quality based effluents where we've put in a system where, you know, we just -- annual average rain, but it's a function of the site and, you know, so --

Q. And whether the permit would be violated in a 1- -- in a 5-year rain event or not, right?

A. Right, or what the regulatory, you know, whoever is working with us on the permit, is really their interpretation and what can be --

MR. LOVETT: Thank you.

THE WITNESS: Uh-huh.

THE COURT: All right. Anything else?

MR. HURNEY: No, sir.

THE COURT: All right. Sir, you're excused. Thank you.

THE WITNESS: Thank you.

THE COURT: All right. It's time to adjourn. We're going to adjourn until 9:00 a.m. tomorrow. I'd like to see counsel in the conference room for a few minutes before we leave. We'll adjourn until 9:00 a.m. tomorrow.

(Proceedings adjourned at 5:24 p.m.)

I, Teresa M. Ruffner, certify that the foregoing is a correct transcript from the record of proceedings in the above-entitled matter.

s/Teresa M. Ruffner November 29, 2010